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What Ford's
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Will Be Like PAGE 102

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90th
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May 1962

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From stern to bow, she extended 804 feet—more than three city blocks of girders, gondolas, and explosive gas. And luxury—you could even take a shower. And speed—2½ days to cross the Atlantic. And tragedy—at 7:25 p.m., May 8, 1937, in the form of a yellow column of flame. Read the dramatic double-length epic of the Hindenburg on page 85.

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A piggyback home? Sure. It slips over your car like a beach clog, rises up hydraulically when you stop for the night. Read about it on page 122.



Now . . . be the first Chief in your neighborhood to build a totem pole. For easy-to-follow instructions, see page 154.

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PS readers talk back



Crankcase Blow-by

There seems to be a need for more investigation before fitting all cars with the new crankcase-ventilation device ["Detroit Report," Feb., p. 62F]. There are a good many questions to be settled.

How much, if any, of the smog-causing gases are eliminated? A Stanford University chemist warns that by removing hydrocarbons we may be busily increasing the nitric-acid content of the air.

There is danger, too, of causing serious engine damage if the device becomes clogged. If it causes a carbon buildup, a car owner might find he has to buy premium fuel to prevent engine knock.

Why should the car owner be forced to pay five or six dollars extra for something that is of questionable benefit to him or his community? Just who is doing the engineering of our cars, the automotive engineers or Washington bureaucracy?

R. W. MARTIN, No. Miami, Fla.

Two for Diesels

For an engine that is not only omnivorous ["Will Tomorrow's Cars Burn Kerosene?" Feb., p. 74], but a gourmet, too, look up one made by Crossley Brothers in Manchester, England. With merely an adjustment of the fuel heater to suit the fuel and a kerosene starting cup for the heavier types, it will burn anything from asphalt to sewage-plant gas, from corn oil to peanut oil.

On swirling combustion chambers, talk to L. Gardner & Sons, also of Manchester. Since the early Thirties they've been making diesels incorporating a swirling chamber that really swirls. They use a shrouded intake valve to get the air started around. When the piston reaches the top of its stroke, it comes to within 1/32 of an inch of the head and the air is driven out violently into the combustion chamber, which

is nothing more than a cup in the piston top. At the proper instant, the fuel is injected and the combustion is complete, smooth, and quiet—no rap or bucking idling characteristic of diesels. The first piston up fires every time, no matter how cold it is or how long it has been standing.

North American engineering—with its utterly inaccessible screaming monsters—is a generation behind Europe.

DONALD TREPANIER, Bella Coola, B.C.

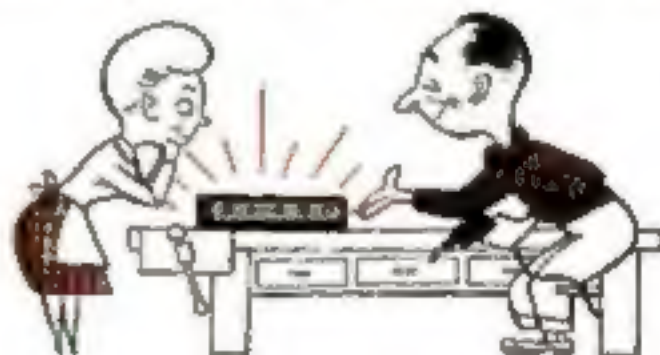
... Who says diesel cars "won't go faster than 60 m.p.h.?" I've driven a '59 Mercedes-Benz 190D well over 50,000 miles in the past 2½ years. The top speed of this car is 82 m.p.h. I have had it up there to see what it would do. In the Far West, in the wide-open spaces, I've driven it hour after hour at 65-70 m.p.h.

I wouldn't trade it for anything on the road. I average over 30 m.p.g. for all driving. Diesel fuel in most states (not New York) is cheaper than gasoline. The car is so comfortable that I have driven 600 miles at a stretch without undue fatigue. It is, in my judgment, somewhat overpriced here, but I took delivery in Germany and saved about \$900 so that for overall driving it will turn out to be the cheapest car I have ever owned.

REV. ROY S. SMYRES, Jamaica, N.Y.

Kit Bug Bites Him

I especially enjoyed "Suddenly Everybody's Soldering" [Feb., p. 124] since I have built both a Heathkit FM Tuner and a Knightkit 12-watt amplifier. They were fun to build, as



well as educational. Before I built them I didn't know a resistor from a capacitor. Now I have enough nerve and knowledge to try building some tougher projects.

M. R. JOONDEPH, Ridgewood, N.J.

Fairlanes, Falcons, and Chevies

Your comparison chart ["10,000 Miles in a Fairlane," Feb., p. 82] shows that the Chevy II costs less per mile to run, but no mention was made that the Chevy had a four-cylinder engine and was pulling about 500 pounds less than the Fairlane (with a V-8 engine). The Falcon gives better gas mileage than the Chevy II although it weighs about the same.

LAWRENCE HABEL, Millbury, Ohio.

... I do a lot of traveling at 70-75 m.p.h. in my new Fairlane and I notice no ill effects in

CONTINUED

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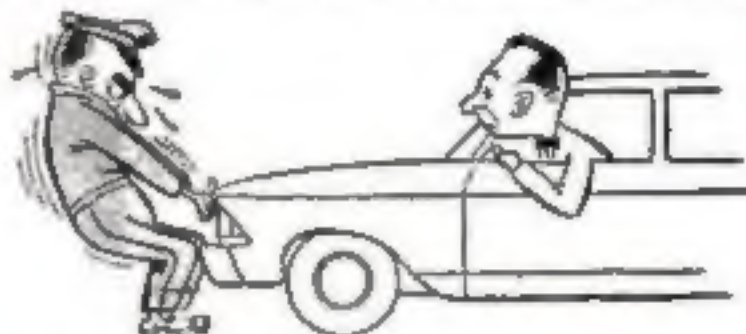


LUFKIN

SAGINAW, MICHIGAN

crosswinds. The car feels very stable. When I first drove it, I had the feeling that the rear end wanted to break loose—but I learned how to take the corners.

It's got power for the hills of the Sierra Nevadas, maneuverability in heavy city traffic, and is easy to park. The engine idles so smoothly I can't tell whether it's running or



not. But the hood drives service-station men crazy trying to open it. Most of the time I have to do it myself.

BRIAN CALLAGHER, Reno, Nev.

Why Water Injection?

I disagree with Mr. Fleming ["PS Readers Talk Back," Feb., p. 39], who says that water injection is used to cool the fuel-air mixture after it leaves a supercharger. Water injected into a fuel-air mixture vaporizes in the cylinders of an engine, absorbing the heat of combustion. Engines running at the top end of the power range run on an excessively rich mixture. Extra fuel is added to the fuel-air mixture to cool an engine and prevent detonation. Water is used instead of excess fuel, allowing an engine to develop more power.

On Air Force engines this shows up as reduced fuel flow and higher torque with the same r.p.m. and slightly lower manifold pressure.

S/SGT. J. E. MUMFORD, APO NYC.

It's No Secret

Hooking a tape recorder to a telephone ["Build an Electronic Phone Secretary," Feb., p. 147] to answer the phone and take messages may get you a trip to the pokey. My telephone directory carries a warning that there is a federal law against recording telephone messages without a beep signal every 15 seconds, something your gadget does not provide.

ROBERT CRAIN, Ft. Pierce, Fla.

Southern Bell Telephone directories warn that a beep is required when "conversations" are recorded. The federal law to which you refer pertains to wire-tapping. The beep warning protects the telephone user who does not want his words recorded. But the message recorder immediately announces to the caller that his words will be recorded.

Sleephappy Railroads

Let me set straight Mr. Rider ["PS Readers Talk Back," Feb., p. 6] who complains of ex-

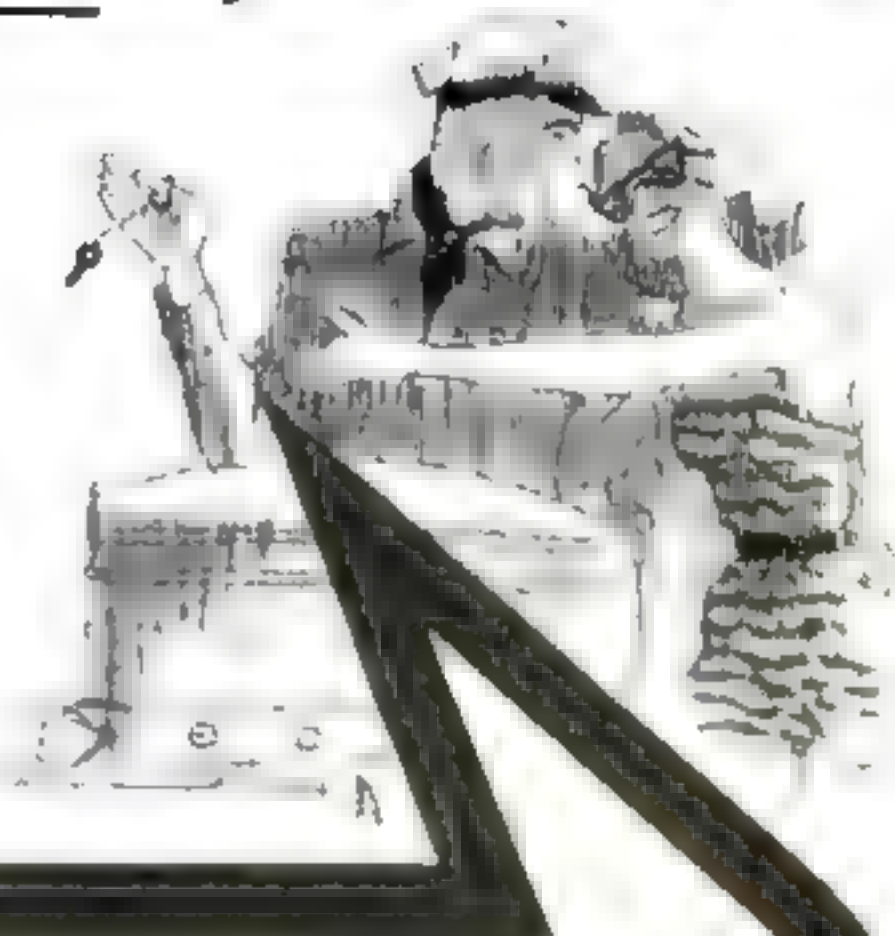
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cessive crew and crew-car changes on super-freights.

The basic working day for the crew is based on mileage, not hours. Since the mileage was set up around World War I, the speeds of today's trains have made the distances obsolete.

Certainly the railroads have been caught napping—they've been shipped sleeping pills in



the form of obsolete rules, regulations, and legislation. Let's hope that an overdose doesn't kill them.

STEPHEN LAFFERTY, Philadelphia.

... That railroad needler doesn't know much about law. Some states require three men in the diesel engine, others require two. This means the trains must stop to pick up or let off a man at some state lines. Also, some states require crew changes every eight hours. There are many obsolete laws on both state and national code books that need revising.

MARK W. HENSCHEL, Dubuque.

Carry a Coffee Can

What gives with the F-85 Olds? I just bought a two-door coupe and was I surprised! When I took a few friends for a ride in the back seat, we found there were no ash trays. What do you do with a burning cigarette? Throw it out the window?

FRED G. FREER, Plainview, N.Y.

Free Water for the Lawn

Some other home owners might like to take a tip from my husband. He has hooked up our washing machine so that by moving the drain hose just outside the window I can water the lawn with the rinse water. I drop the hose into a two-gallon garbage can. Attached to the can are three hoses that stretch octopus-like across our back yard.

A hole is filed in the lid of the can just the size of the drain hose. The water runs out a fitting which is connected to the octopus by a short piece of hose at the bottom of the can. The can is painted green for appearance's sake.

The system reduces the water bill considerably in this hot, dry climate.

MRS. D. J. GERSZEWSKI, Tucson.

Midget-Engine Engineers

Last spring I built this little model from your bonus blueprint ["Air-Cooled Hot-Air En-

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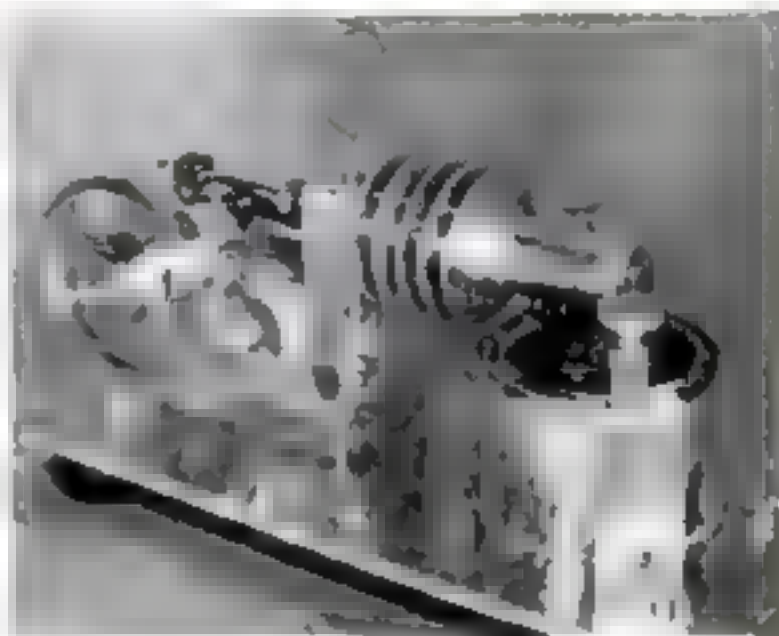
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TRI-STATE COLLEGE

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gine," Apr. '61, p. 142], and recently I gave it a real workout at a hobby show. I started it up at 1:30 and kept it running until 9 o'clock, stopping it only to change the canned-heat cans and eat supper. I'd say it ran successfully



for about six hours. I cut a smaller hole in the lid of the can so it wouldn't get so much heat when I found that it ran too fast. I am now planning a bigger model.

LEO STECKEL, Cedar Rapids, Iowa.

... Your little hot-air engine so intrigued and fascinated me, I had to build one. Using my neighbor's machine shop and a smattering



of high-school shop practice, I began a pleasing but (for a novice) very arduous task. After many miscalculations, numerous heartaches, and some shameful language, I came up with one of the sweetest-running, most carefree little engines imaginable.

I use the word carefree because the main piston cylinder, displacement-rod bearing, and crankshaft housing were made of "Oilite" bronze. This oil-impregnated material eliminates the need for lubrication.

CHARLES KOLAR, Chicago.

Case of the Sweating Casements

THE fellow troubled with a smeared windshield got so many cures for his problem ["PS Readers Talk Back," Jan., p. 16], that I thought I'd pose one and hope for similar results.

How do you cure sweating windows in the home? I have aluminum casements in a new

CONTINUED



CUT OUT AND "TACH UP" IN A NEW TEMPEST LEMANS

Tempest's frisky LeMans (convertible or coupe) can please you in as many ways as there are roads. No wonder; under the hood lurks a four-cylinder engine that runs around acting like a V-8. A four whose hottest version (optional at extra cost) develops more horsepower and more torque than any other production four in the everlovin' world.

Tell you what you do, just for kicks: hook that 166-hp plant up to Tempest's 4-speed stick (optional at extra cost). Run through a quartet of quick, positive shifts, and see how you like it. We have a good idea it'll set you thinking about the rear axle you'd like in your new LeMans. You've got five to pick from: 3.08:1, 3.31:1, 3.55:1, 3.73:1, 3.90:1, all available at no extra cost.

Of course, any engine 'transmission pairing you like delivers a whopping big serving of Pontiac punch. (If you're after the lazy life, you couldn't do better than Tempest's automatic—an extra-cost option.)

One thing, though: you'll have to install your own tachometer to measure Tempest's fast-winding four. Go right ahead. But tach or no, Tempest's going to make you happy. We'd bet on it.

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TRANSMISSION GEAR RATIOS	REAR AXLE RATIO CHOICES				
	3.08:1	3.31:1	3.55:1	3.73:1	3.90:1
3-SPEED MANUAL					
1st—2.54:1	N/A	8.73:1	10.41:1	10.94:1	11.47:1
2nd—	N/A	5.45:1	6.41:1	6.74:1	7.05:1
3rd—	N/A	3.31:1	3.73:1	3.90:1	4.05:1
Reverse—	N/A	1.94:1	2.20:1	2.30:1	2.39:1
4-SPEED MANUAL					
1st—4.5:1	7.4	7.62	7.94	8.16	8.24
2nd—2.5:1	4.2	4.3	4.4	4.5	4.5
3rd—1.4:1	2.44	2.5	2.6	2.7	2.7
4th—1.0:1	1.54	1.6	1.7	1.8	1.9
Reverse—3.66:1	3.66	3.66	3.66	3.66	3.66
TEMPESTORQUE AUTOMATIC					
Low (Plus Converter) 3.14:1	1.27:1	1.45	1.49	1.58:1	1.60:1
Low (Gear Only) 3.1:1	5.6	6.02	6.34:1	6.74	7.10:1
Drive—1.00:1	3.74	4.02	4.2	4.3	4.4
Reverse—2.2:1	5.51:1	6.02	6.44	6.9	7.30:1

*The higher the total torque multiplication figure the faster the engine will be turning at a given road speed and the livelier the performance. †Must be special-ordered.

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well-insulated home and have a terrible condensation problem. Have any readers a good, economical solution?

J. C. SCHNEIDER, Belle Vernon, Pa.

First step: Check back on August '61 PS which contained a roundup on how to beat humidity by ventilating, dehumidifying, and—an economical method—painting with a special formula paint.

Radioactive Rain

I use rain water in my steam iron. Is there any danger of the iron becoming radioactive



from fallout? The newspaper said we would be getting it in snow and rain this spring.

Mrs. PAUL RICH, Watertown, N.Y.

The radioactive content would be negligible.

Pistol-Grip Torch Search Ended

WE NOTICED the picture of the handle-grip propane torch ["PS Readers Talk Back," Jan., p. 14]. We have access to an actual pistol-type grip which has an automatic lighter and operates like a gun with 12 feet of hose, and regulator and pressure gauges.

EARL ROBBINS, Secy.

A-B Gas Co., Inc., Bloomington, Ill.

"Biggest Ship" Gets Smacked Down

THE USS Constellation ["PS Picture News," Jan., p. 87] is not the largest ship in the world. The USS Enterprise, first nuclear-powered aircraft carrier, holds that distinction. It is 1,123 feet long, 252 feet wide, and has 4.47 acres of flight deck (Constellation has only 4.1 acres). The Enterprise is as tall as a 23-story building and carries a crew of 4,600, including the air group.

The people of Newport News are proud of the ships built here—and especially proud of the Enterprise—and we'd like to see that she gets the credit she deserves.

W. M. RAPER, Newport News, Va.

To-Do About Rambler

Why all the to-do about Rambler's "automatic" stick shift and dual braking system ["10,000 Miles in a Rambler American," Mar., p. 60]? My father owned a 1938 Terraplane that had a vacuum-controlled clutch, not unlike the Rambler's. He now owns a '51 Hudson

[Continued on page 16]



Photo graphed on transfer in Florida a future 5000 ft.



a MERC doesn't have a nose to get in other people's business

A Merc doesn't have a big nose like some motors. Its lower unit doesn't gather weeds, hook logs, foul trotlines or ski ropes.

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moments. (Have you ever tried to change a shear pin at sea?)

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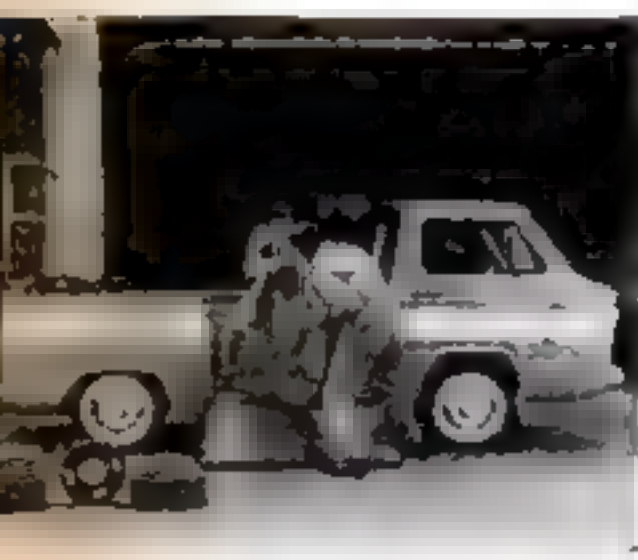
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WORK-AND-PLAY



VERSATILE RAMPSIDE PICKUP

Talk about workers! Chevrolet's Corvair 95 Rampside pickup is a proved-on-the-job hauler that waltzes away with payloads of up to 1,900 lbs. thanks to four-wheel independent suspension, unitized body-frame construction, Unipack power team and much more. And, when it comes to play-time, this one takes to a camper body like it was made for sports and nothing else! Side gate drops to give an easy-loading ramp or handy camper door.



DOUBLE-DUTY CARRYALL

Hard-working panel-type carrier or crew bus on one hand . . . next thing to a station wagon (or portable camp) on the other. That's the Suburban Carryall—versatility unlimited! Room for 3, 5, 6 or 8 people, supplies and gear, depending on how you arrange seats. And you get a smooth ride with independent front suspension.





CHEVROLETS!

Weekday breadwinners, week-end trail blazers! These Chevrolets are built to lead a double life. They're hard-working savers that sail through giant-sized jobs day in and day out. Then, presto!—they're easygoing fun-lovers rarin' to go all-out on a holiday.


It's the way they're made that makes them work so well both ways. The worth-more, work-more build that makes them top hands on the job also makes them top-notchers on the trail.

Roomy, relaxing cabs, for instance, that even the gals will go for. Rugged good looks and go-anywhere components that can't be beat on tough truck jobs or off the beaten path. With Chevrolet's advanced independent front suspension, you get a road-gentling ride that's as kind to cargoes as it is to people.

And with all this goes camper body equipment of all kinds, ideally suited for Chevrolet

Fleetside, Stepside or Corvair 95 pickups. It's easily available from leading manufacturers all over the country to make the Chevy you pick a versatile quick-change artist at work or play the year around.

Whatever your hauling job, however the outdoors is calling, there's a work-and-play Chevrolet you can tailor to the activity at hand. A Fleetside, Stepside or Rampside pickup with a low, wide pickup box that's just right for camper body installation. Or a Suburban Carryall that looks enough like a station wagon to be one, carries up to 8 people and lots of gear or with rear seats out, even a 12-foot boat.

Before you hit the trail, get on the trail of a work-or-play Chevrolet during the special Fun 'n Sun Days at your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2,  **CHEVROLET** Michigan.

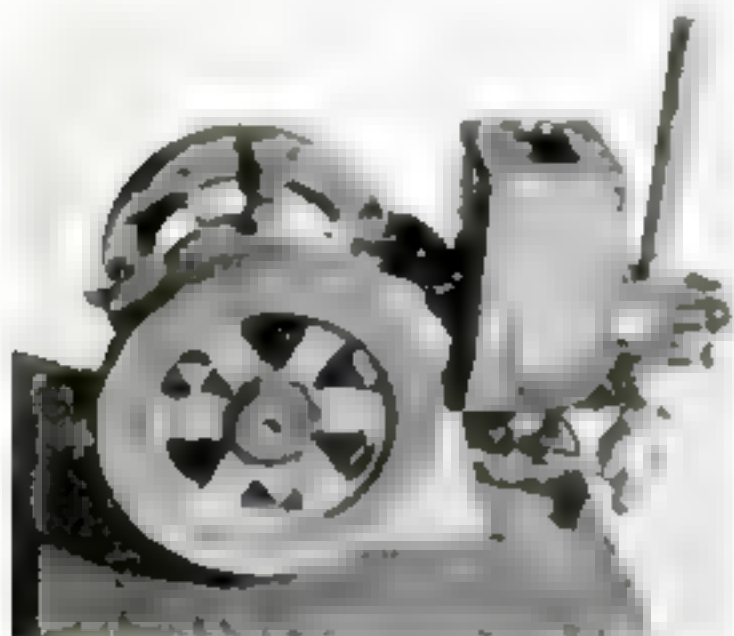
Super Six that takes care of the brake-safety problem. If the hydraulic brakes fail, the pedal automatically engages the emergency-brake cables to operate the mechanical brakes on the rear wheels.

I might also add that Hudson had one of the original compacts: the Hudson Jet. A comparison of this car with today's compacts might be an eye-opener.

T. BANASZAK, Whiting, Ind.

What's It For?

Maybe one of your readers could identify this little engine, which is marked G. M. Co. on top of the water jacket. I'd like to know who



manufactured it and when and its intended use (toy?). It is approximately 14 inches long, has 8½-inch flywheels, and at one time must have had a make-and-break magneto ignition system. Attempts to rig an ignition system using a car coil haven't been very successful.

The engine was picked up by my father some years ago. Mechanics and engine collectors who have examined it are as confused as I am about its origin.

T. M. WEST, Berkeley, Mo.

The Things You Hear!

I understand from a dealer that Buick has called in all V-8 cars to have the engines replaced. Is this true, and why?

GEORGE G. PHICZ, Triangle, Va.

It's not true.

Spring-Back Road Dividers?

Instead of the white line on highways, why don't they insert little strips of rubber? They'd be ½-inch thick, an inch or two wide, and two or three inches high, and have the appearance of a small picket fence down the middle of a road.

Wire, or fabric like that in a tire's carcass, could add rigidity. They might even be made to reflect at night, in rain, fog, or light snow.

By altering the color, size, shape, or grouping, the strips would serve in place of signs to indicate speed limit, dangerous curves, hills. And a driver could keep his eyes on the road.

BEN COMBS, Chesapeake, W.Va.

He's Got It Made

THE hit on electricity from the septic tank ["The March of Science," Jan., p. 29] sure interested me. By coincidence, a few weeks previously I had been fooling around with a surplus two-inch tuning meter to which I had attached a copper wire at the positive terminal and a small rod of aluminum at the negative

CONTINUED

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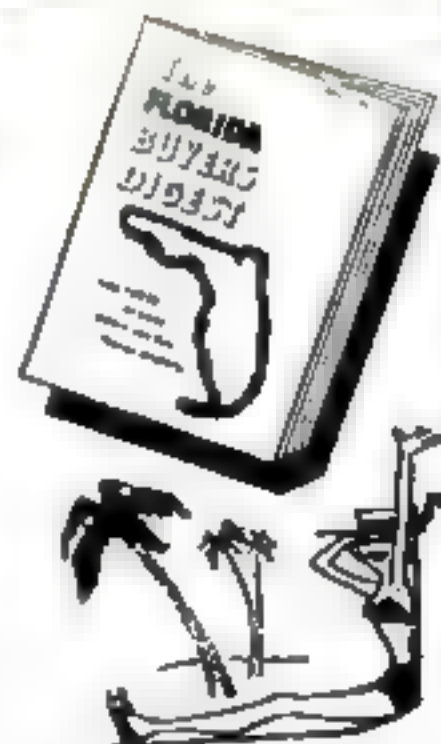
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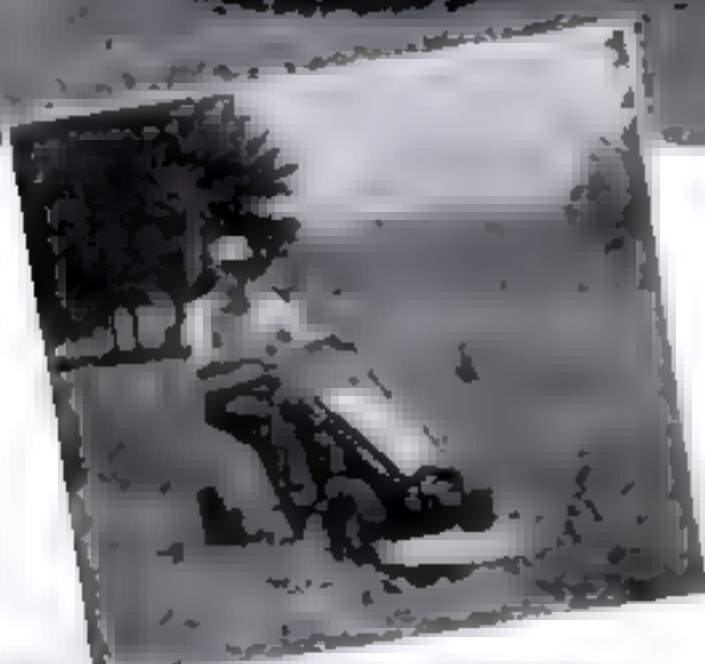
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terminal. After trying this in many different solutions, I put the leads into galvanized washtubs filled with wash water. The result: a full left reading on the scale.

HAROLD SACK, Watertown, Wis.

He'd Sink for Shame?

I don't think I'd want to wear that Mae West life vest ["Safety Wear Afloat," Mar., p. 133] under my regular jacket. Suppose I accidentally triggered the CO₂ cartridge while the outer jacket was buttoned up? I'd feel like a blowfish inside a lobster shell!

J. M. MCKENZIE, Ft. Worth, Tex.



Answered S.O.S.

If that fellow who wanted uses for discarded electric shavers ["PS Readers Talk Back," Feb., p. 40] is a gardener who starts his seed early, this is for him.

Wrap a piece of inner tube halfway around a vibrator shaver, letting the rubber extend about two inches in front of the vibrator. Mix a little very fine sand with any seeds to be planted and put the mixture on the inner tube just in front of the vibrator. Turn on the razor and the seeds can be placed on the plant flats without getting them too close together—the usual problem.

E. P. DATZ, Verona, Pa.

Picking from the Back Stack

Saving past issues paid off for me. I filed away one with plans for a Geiger counter [April '55] with the hope of some day picking up a moderately priced Geiger tube. Recently I saw such a tube advertised in PS. Although not the one specified, I used it in the circuit. It worked perfectly.

Then I went you one better. I took the earphone off a cheap germanium diode crystal radio and passed the output through the 3S4 tube of the counter, which amplifies it. So, by just the flick of a double-throw switch, I have a Geiger counter or a portable radio. The radio's sensitivity, of course, is affected by location, but it works well in some spots with no ground other than one's fingers.

J. OLIVER STURK, Ottawa, Ont.

Help-Wanted Department

WE HAVE a crank in our neighborhood who periodically goes on a spree puncturing tires on parked cars. He has not yet been caught after three years of activity.

Does any reader know of any mechanical or electrical device we might use to stop this nut?

FRED B. TUROFF, Philadelphia.



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The march of SCIENCE

By Martin Mann

Can we harness whales for antisub patrol?

Among the many far-out schemes in research on antisubmarine warfare is a new plan to put whales to work. Lockheed scientists are going to plant small, battery-powered soundmakers in the blubber of whales (the gadget is part of a dart that will be shot into the whale's back from an airplane). The sounds from the swimming whales would then be picked up and recorded by a



ship cruising nearby. The idea is to learn more about the transmission of sound from very deep water—whales can dive deeper than our best submarines.

Would it be possible to go farther: train whales to patrol the ocean bottom for us, like an underwater K9 Corps? You wonder. These animals are mighty smart. Navy scientists just recently recorded what seems to be an intelligent back-and-forth conversation among a group of whales.

Maybe you, too, are an unnoticed genius

Both Edison and Einstein were considered pretty dull, if not stupid, when they were kids. Even today, there is no sure way to pick out the great ones—the real balls of fire—soon enough to make sure they get the training and encouragement their talents deserve. Too many are lost.

Now scientists hope to stop this waste of human resources with better ways of telling who has the priceless spark of genius and who hasn't. At the University of California, for example, Dr. Donald W. MacKinnon analyzes "creative individuals" to learn what makes them that way. Some of his findings will surprise you.

Dr. MacKinnon works on living specimens, certified to be outstanding by experts in their own fields. These human guinea pigs are often famous people and their names are ordinarily kept secret. Occasionally, however, somebody spills the beans—Truman Capote, author of *Breakfast at Tiffany's*, and Max Shulman, creator of *Dobie Gillis*, have said that they were among the chosen.

In the past six years, 530 engineers, mathematicians, industrial-research scientists, architects, writers, and college students—all highly creative—have checked in at the rambling old house in Berkeley that serves as a laboratory. There they were subjected to batteries of psychological examinations. (The tests were originally worked up in World War II to select cloak-and-dagger operatives for the Office of Strategic Services.)

It turns out that truly creative people—not dreamers, but men

who invent original solutions to real problems and then carry through their solutions—are different, all right, but in unexpected ways.

They're not necessarily very smart. None are feeble-minded, but their actual IQs don't seem to matter much.

They do not shine in school. Their college grades—even among the scientists—had run to Bs and Cs. Many wouldn't be able to get into graduate school, the way entrance requirements stand today. One of the most outstanding architects had actually been counseled by his dean to take up something else because he had shown no talent for architecture.

They are curious and skeptical, with an unusual knack for getting the right answers with what seem to be the wrong questions.

They are very sure that the work they do is right and important—no matter what anybody else thinks. (This is the way geniuses are supposed to act, and they do.)

They prefer to do things the hard way. They choose drawings that are more abstract than the ones other people select, and when they make up patterns themselves, they use more colors. Apparently they can imagine higher types of simplicity and order than the less gifted can.

They are not at all stiff-upper-lip types. They reveal their own feelings and sensitively read others'—the way women do—but are otherwise very masculine.

They are all highly intuitive, focusing on what could be rather than on what is. But beyond that there are striking differences among inventive types. Writers go by feel without making judgments, scientists weigh things logically and come to firm decisions. Architects are in the middle, some leaning one way, some the other way.

They are mavericks, ruggedly independent in their beliefs and ideas. Outwardly, however, they conform to the everyday world. They live and behave like ordinary businessmen—the "briefcase syndrome," Dr. MacKinnon calls it.

These conclusions have not yet generated a foolproof test for spotting inventive genius. But they do point the way. How do you measure up?

Sod for a bare pate

Getting thin on top? Maybe you could have some hair transplanted to fill in. It's no joke.

Dr. Norman Orentreich, assistant professor of dermatology at New York University, really does replant hair. He punches out small sections where hair usually grows thickly (the back of the head, for instance) and grafts these sections onto the bald spots. The pieces removed are only $\frac{1}{8}$ inch across, so their loss is easily hidden by hair in adjoining areas. The transplanting operation has been tried on hundreds of patients, and it works nearly every time.



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90 years ago...

From Popular Science's First Year, 1872

VESUVIUS erupted in the spring of 1872. Here's how a London correspondent described it on May 2:

"A tempest of fine ashes poured down upon us, covering the streets and houses, filling our lungs, and almost blinding us. We all, from necessity, carried umbrellas, a slight protection, however, except to break the brunt of the driving shower as we met it. Last Friday and Saturday it was, as it were, one continuous roll of artillery, so loud that it could be heard full 20 miles distant; but after the sandstorm set in, if not so sharp and violent, it was, I think, more appalling. Vesuvius roared night and day; it rendered sleep impossible, its reverberations shook our windows and our houses."

"A French doctor has recently been making some curious experiments as to the effect of alcohol on fowls. The birds took to dram-drinking with evident delight, and many a rooster consumed his bottle of wine a day, so it became necessary to limit his allowance. They also lost flesh rapidly, more especially those which drank absinthe. Two months of absinthe-drinking alone was found sufficient to kill the strongest cock or hen. The fowls which indulged in brandy alone, however, lasted four months and a half, while the winebibbers survived for ten months. Their crests also swelled to four times the original size, and became unnaturally red."

From a paper on life and customs in southern Alaska:

"During the Russian administration the natives were obliged to bathe once a week in the steam bath, which was erected in every village. Uncle Sam's advent put an end to this tyranny, and

now each man is free, and remains as dirty as he pleases."

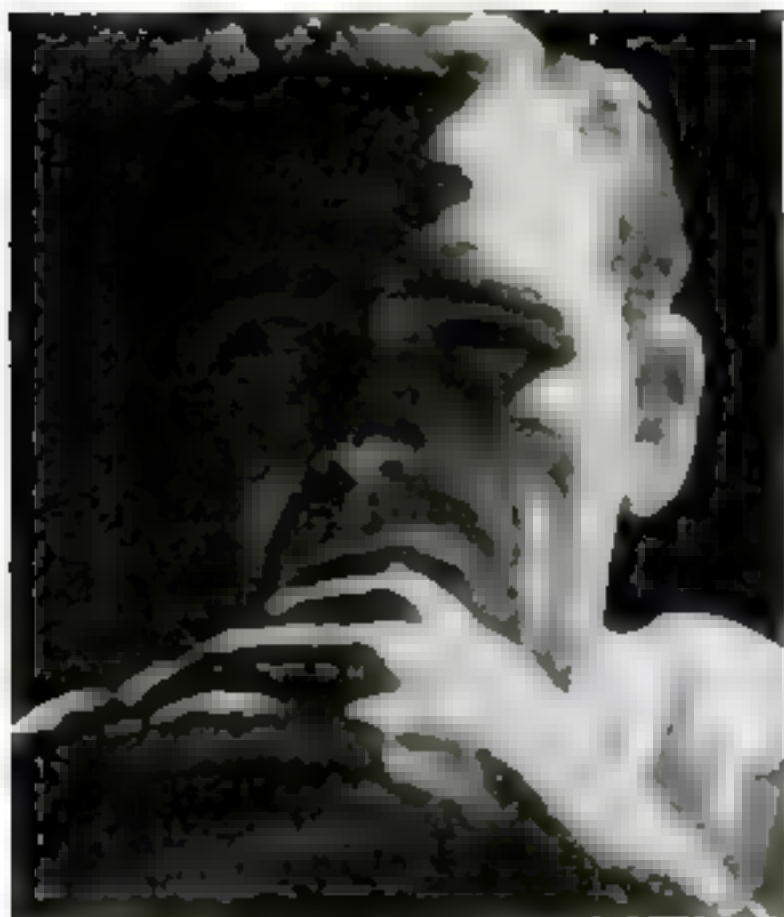
"A certain M. Donac has recently laid before the French Academy of Sciences a project for liquefying dead bodies and transforming them into syrup without color or smell. According to his calculations, a moderate-sized man could be got into six bottles. The size of each bottle is not stated, but the Paris Journal appears charmed with the idea and exclaims, 'What an opening for the exercise of filial piety!'"

"We are going through that change in regard to Mr. Darwin's speculations which has occurred so often in regard to scientific theories. The opinions have gained wider acceptance, and it cannot be doubted that they are destined to modify the future current of thought. Darwinists are not necessarily hoofed and horned monsters, but are occasionally of pacific habits, and may even be detected in the act of going to church."

"M. Heindrich, who filled the office of headsmen in Paris for 54 years, has lately died, after officially cutting off the heads of 139 criminals. He appears to have been a man of some cultivation and made various improvements in the construction of the guillotine.

"A visitor once asked him if he thought the separated head retained consciousness after it had fallen into the basket. Without giving a direct reply, he related several instances to support an affirmative answer. On one occasion, he said, a woman's head had made a faint effort to spit at him; and he also spoke of vital contortions occurring in the facial muscles of another. These movements however are probably reflex."

"Dr. Livingstone's safety is not yet despaired of by his brother, Mr. Charles Livingstone, her Majesty's consul at Fernando Po. He is stated to be confident that the doctor will, in the course of a few months, reach the seaboard at or near Zanzibar."



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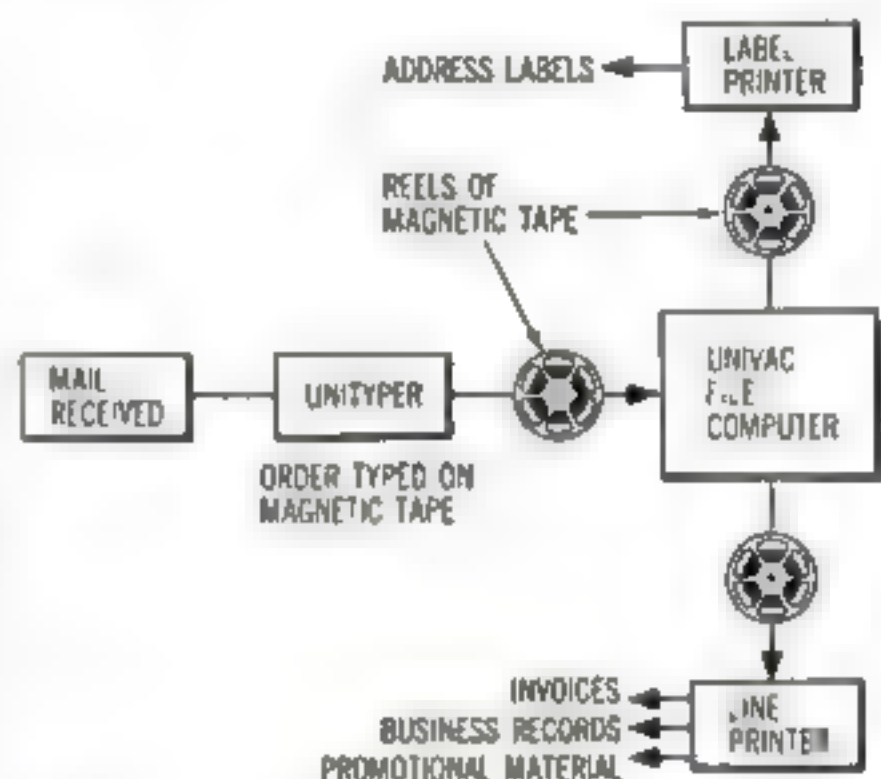
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another subscription for your birthday. When your subscription order arrives at the Data Processing Center in Boulder, Colo., the information on it is typed out on a machine something like an electric typewriter. This makes a printed copy for checking and at the same time records the information on magnetic tape in a coded form that can be "read" by a Univac File Computer.

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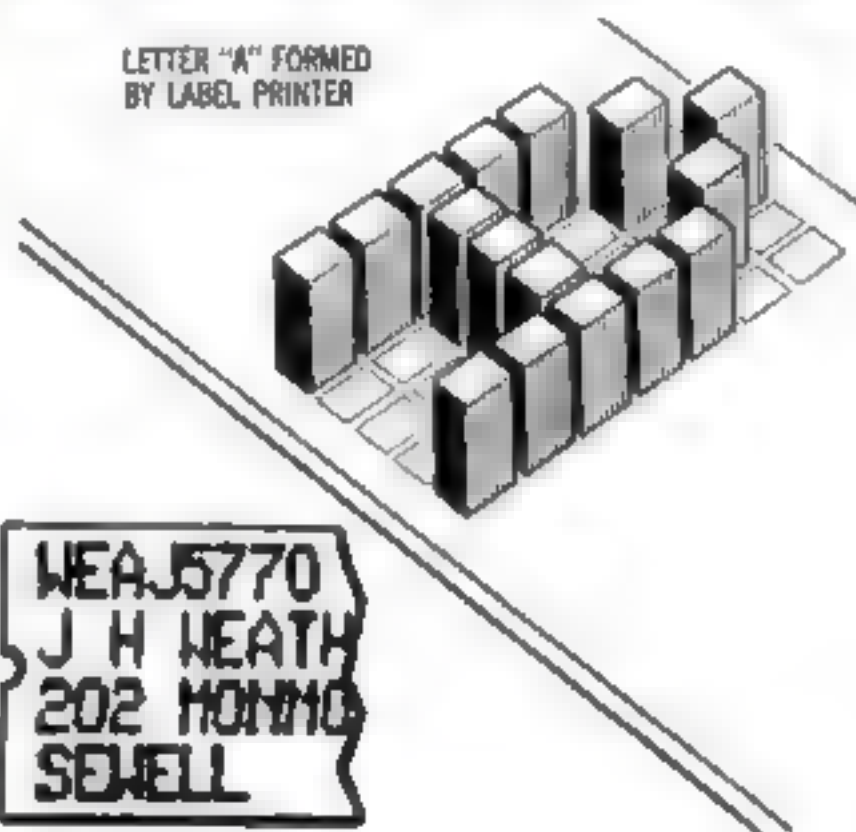
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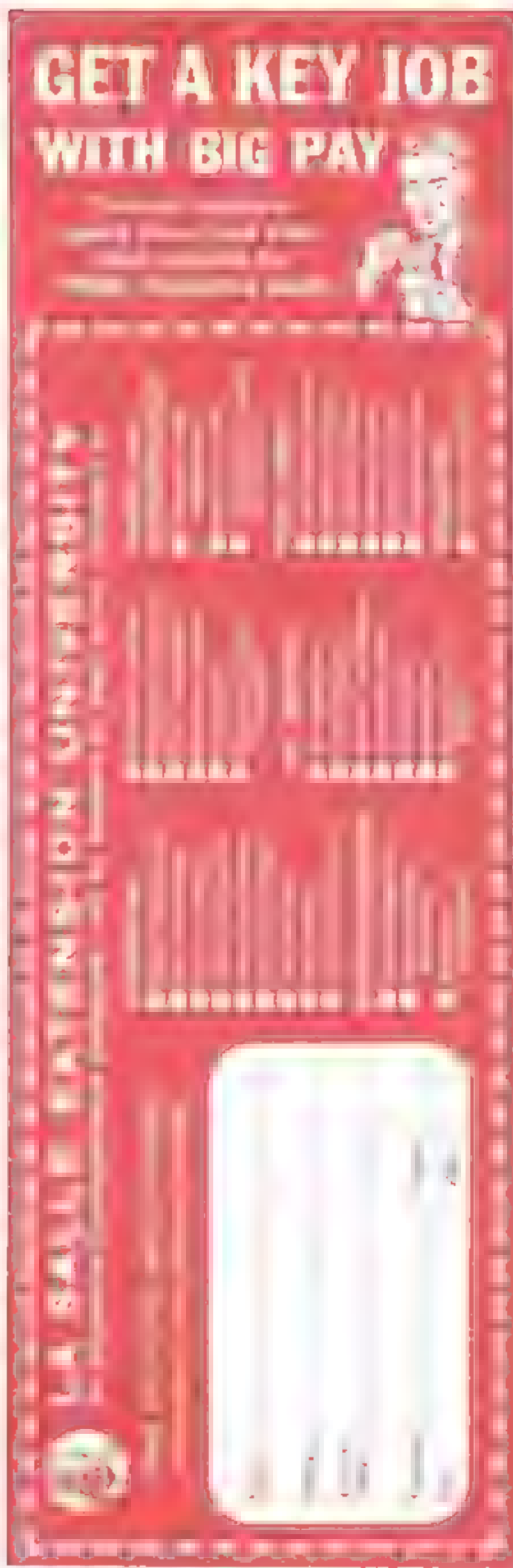
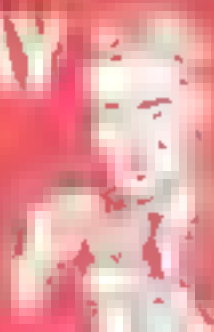
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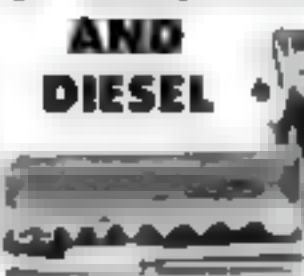


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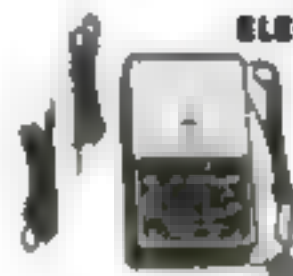
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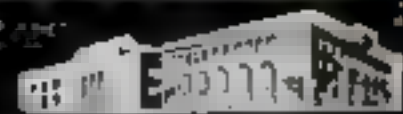


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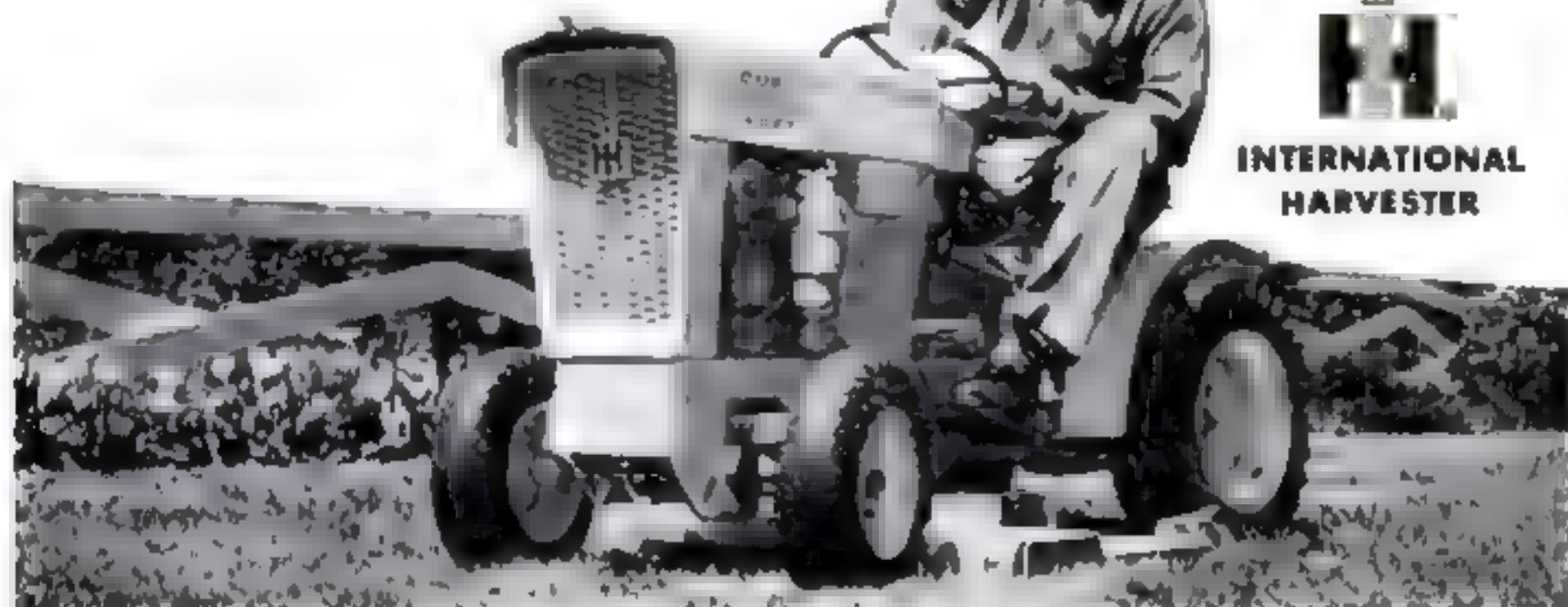
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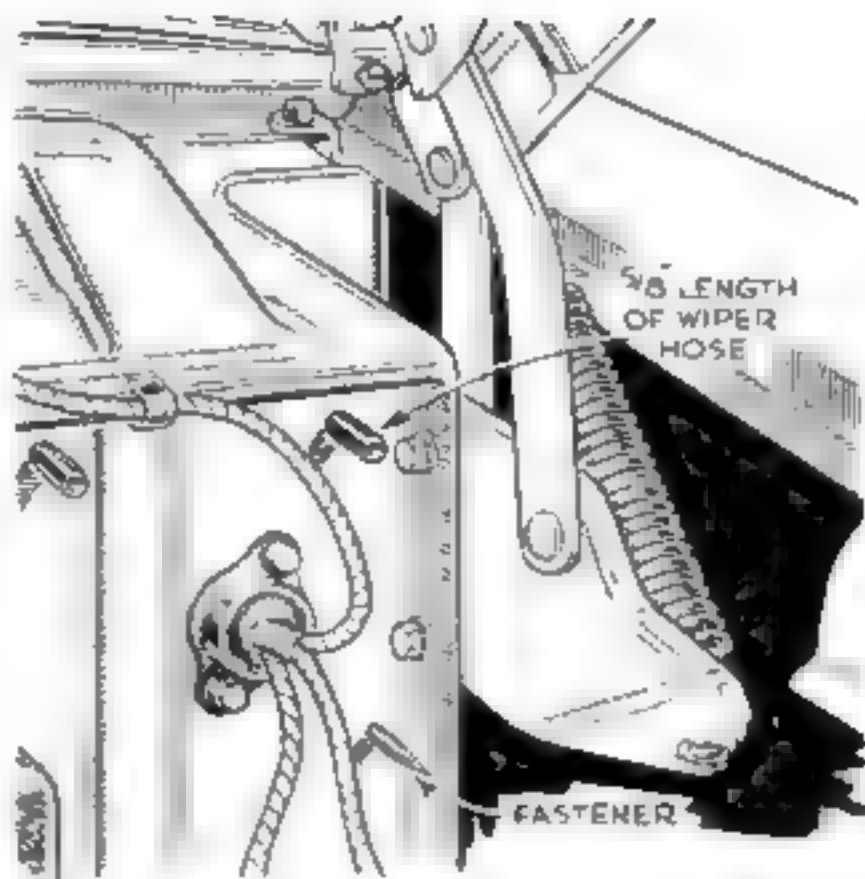
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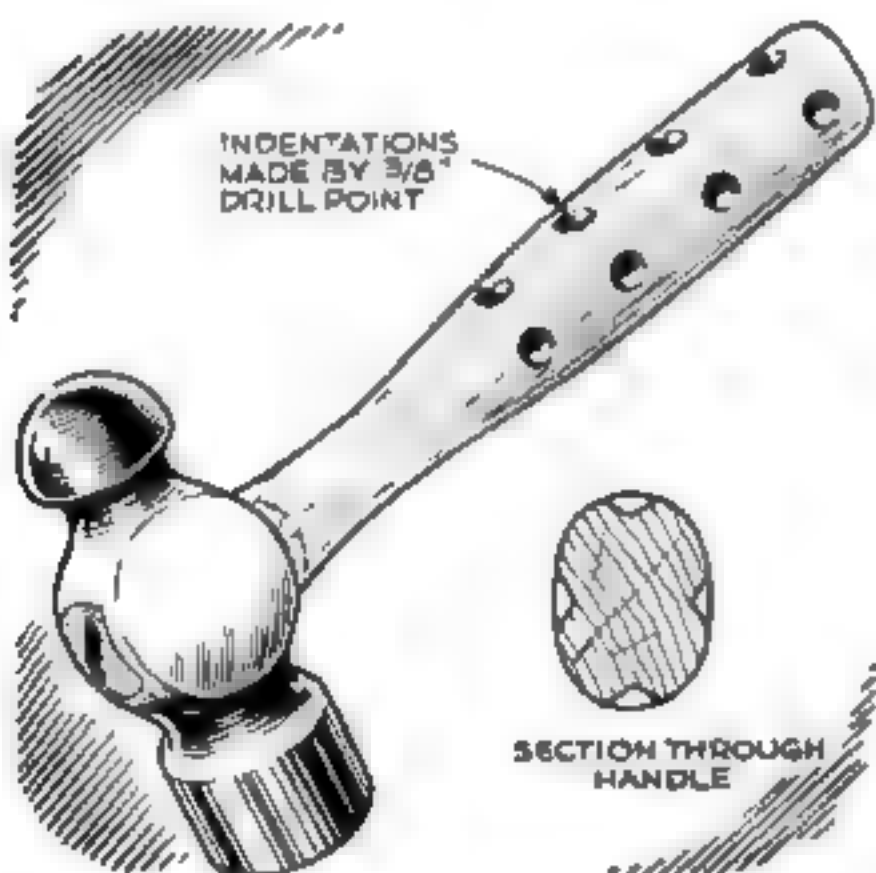
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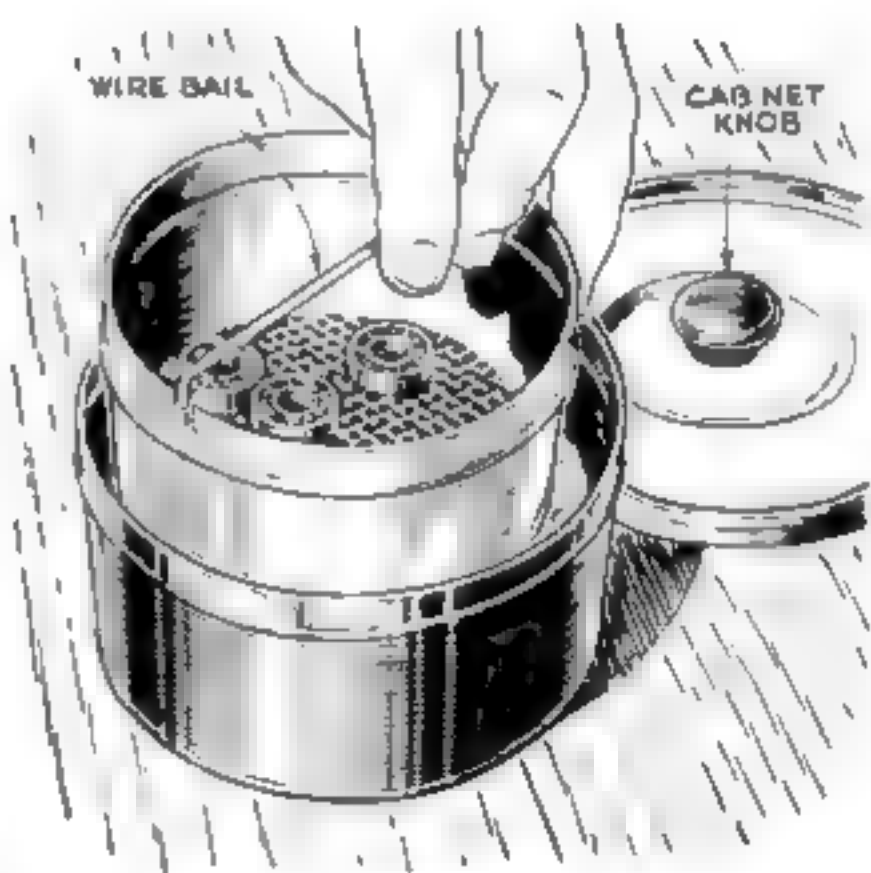
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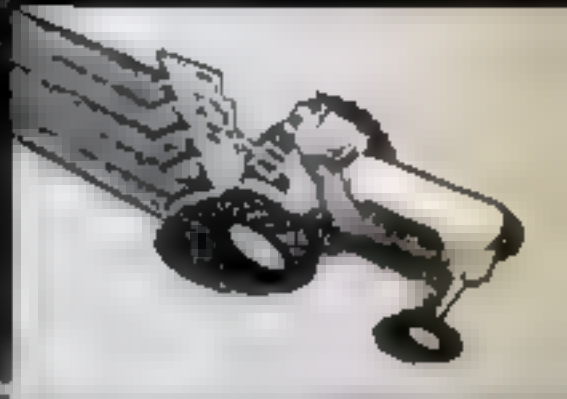


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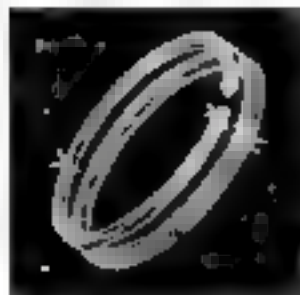
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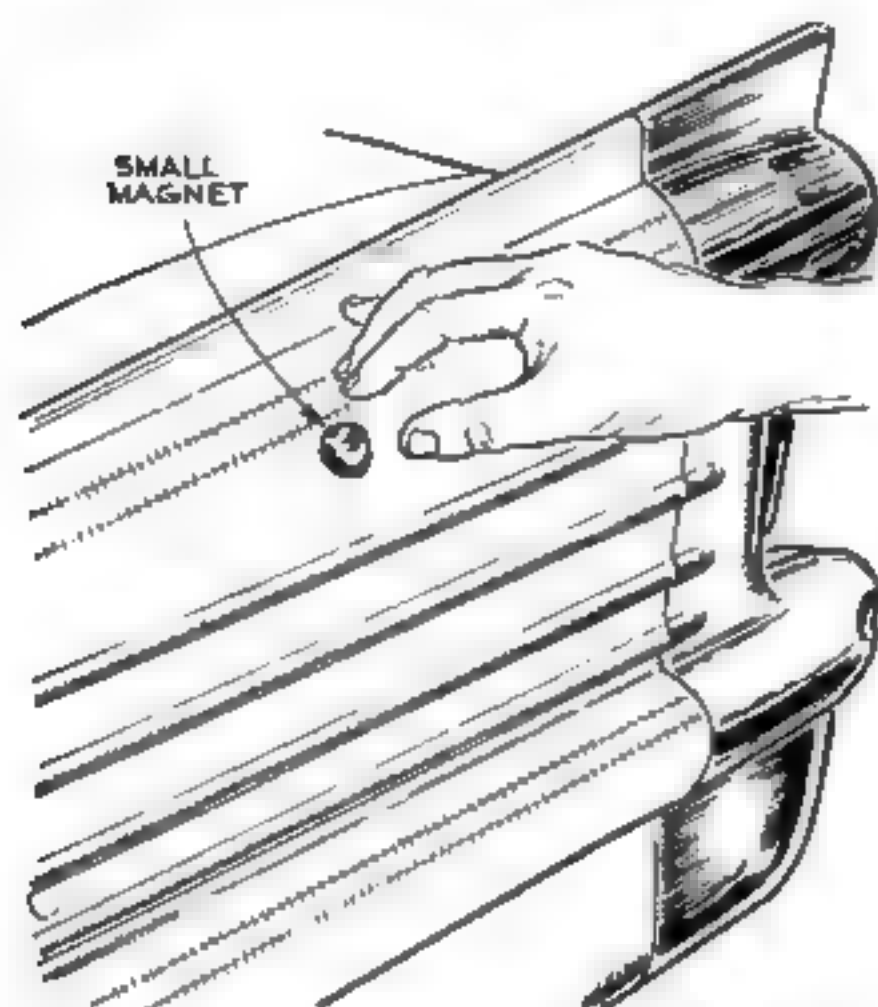
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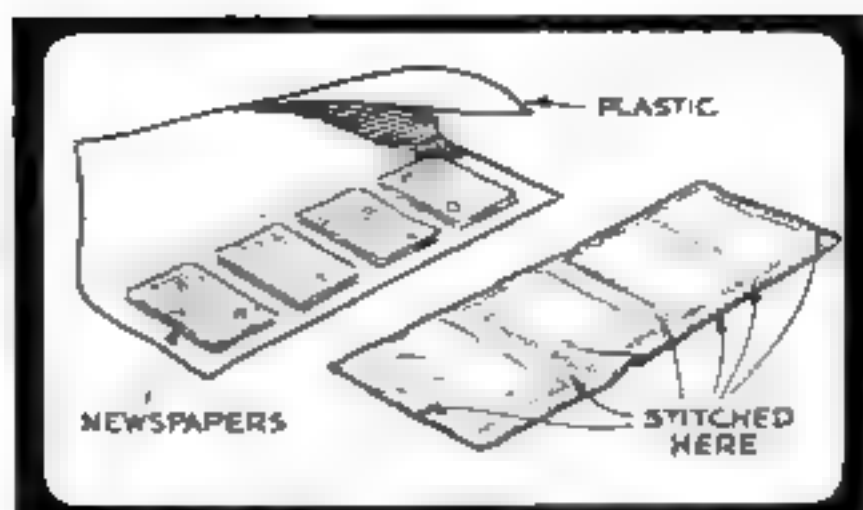
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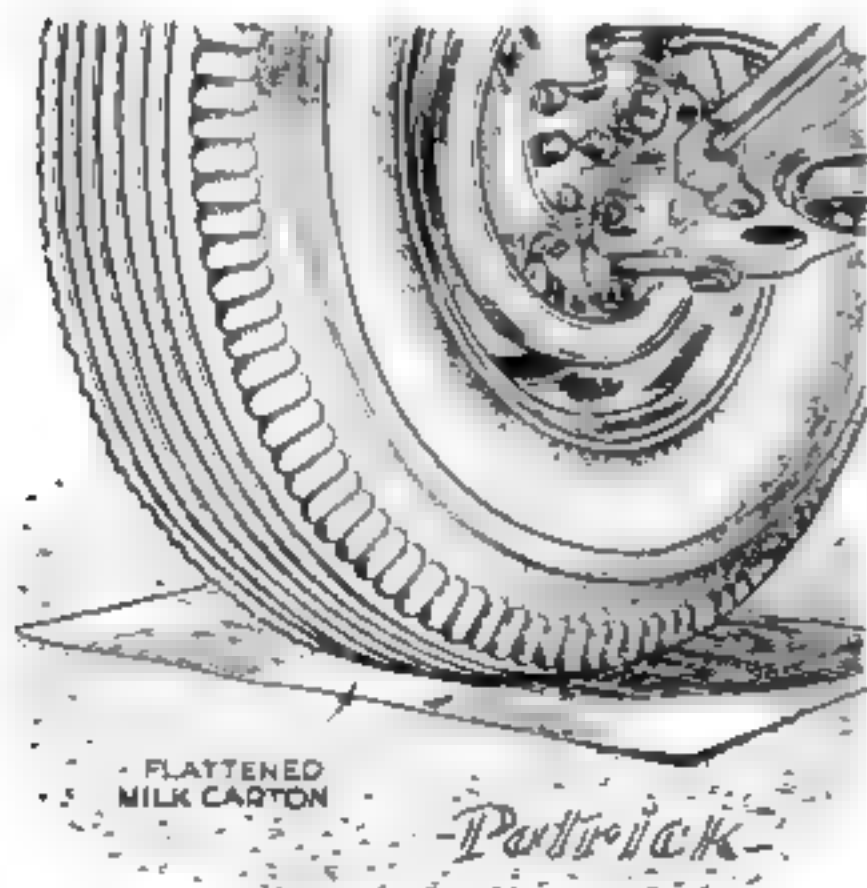
More Hints from the Model Garage



When shopping for a used car, take along a small magnet. Apply it to the body panels and see whether it sticks. If it doesn't, you can be sure that the car has been in an accident and the damage was covered over with fiber-glass or body solder.



A slippery folding plastic mat allows you to slide easily under a car to make repairs. Make it of a 36"-by-72" sheet of roll plastic and four large newspapers. Fold the plastic lengthwise over the papers. Sew around the borders and between the papers.



Reaching ball joints with a grease gun requires moving the front wheels. This is easier if the wheels rest on a slippery surface. Cut the ends off two milk cartons, flatten them, and put them under the tires. It also saves wear on the steering linkage.

Do You Have an Auto Hint? Send It in and Win a Prize

HAVE you discovered or developed a moneysaving short cut for making your own auto repairs? Have you found an easier way to do a difficult job? Got a tip that will make driving safer or easier? Or do you know someone who has an original tip, one not previously published?

POPULAR SCIENCE will pay a cash prize of \$15 for every auto-repair hint accepted for publication each month in "Hints from the Model Garage."

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PRODUCTS OF  MOTOR COMPANY

Detroit report

.....

A 10,000-mile oil

Look for one or more auto manufacturers to boost the interval for changing crankcase oil on the '63 cars to as much as 10,000 miles. The oil companies are in on it. Sun Oil Co., for example, has an oil almost ready for extended-lube announcement. Cost: about \$1 a quart.

General Motors is known to have completed studies on oil-change intervals and is prepared to stretch oil use by buyers of its cars this fall.

Smog (cont.)

Buyers of new automobiles and the federal government may come to cross-purposes when the '63 cars hit the road. The bone of contention: that antismog device. This is the tube, remember, that routes crankcase fumes back to the intake manifold so they won't be spread upon the air and, under the influence of sunlight in some sections of the country, produce eye-smarting vapors. All '63 cars will come with the tube.

First of all, it will add \$5 to \$10 to the cost of a car. Second, it has a valve that requires a cleaning or replacement every 5,000 miles or so. If this service job, at \$3 to \$5 for labor and parts, is not done regularly, ventilation of the crankcase will suffer and the engine lube oil will get contaminated. Sealing moisture, acids, burned and unburned gas, and sludge in the crankcase would increase engine wear.

Car-owner dissatisfaction may turn on the point that there are few areas in the U. S. where smog actually is a problem. Only California has an auto smog law.

General Motors, by the way, has built a "smog chamber"—probably the only thing of its kind in the world—to produce smog on demand for study.

Good-bye tire valves?

The days of conventional metal tire valves, which have been poking out of automobile shoes since inflatable tires were introduced, may be numbered. Several tire companies, under pressure from auto makers to reduce costs, are well along on the development of a rubber-flap valve. It's located on the sidewall, works something like the valve used on a football.

The car manufacturers contend that the conventional valve has been an anachronism ever since tubeless tires appeared. They say the simpler, cheaper valve would make wheel balancing easier, eliminate that hole in the rim—and cost less.

Domestic tranquility

To satisfy both the husband who likes a stick transmission and the wife who prefers an automatic, one auto maker is developing a combination manual-automatic box. It could be switched back and forth by the push of a button on the instrument panel. Whether it will be marketed remains to be seen. How much more would it cost than a regular automatic? Maybe \$100.

A Fordette?

Ford engineers are designing a new sports car to compete with Chevy's Corvette. Little is known about the concept except that it would have a lot of horses and perhaps a fiber-glass body. Tentative introduction: next year.

Supertires

Better car shoes are back in the news. American Oil Co. is marketing the Amoco 120—"the strongest superpremium passenger car tire ever offered to the general public." In tests, it has been driven without failure at 100 m.p.h. for 1,000 miles, at 120 for 300 miles, and at 125 for 75 miles.

Goodyear announces a new synthetic rubber, Budene, said to provide 35 percent more tread miles. Prices for both tires are substantially higher.



FIREBALL, DAN, LEE ROY, AND AUTOLITE MAKE SHAMBLES OF DAYTONA SPEED WEEKS

Fireball Roberts runs the fastest 500 miles ever driven over a closed course to win the Daytona 500 Grand National Race. His record speed: 152.529 mph. His prize: \$24,000. His spark plugs? Autolite. Dan Gurney wheels a Lotus 19 over the twisting 3.8-mile Daytona sports car track, wins the Continental 3-hour Grand Touring and Sports Car Race. His speed? 104.101 mph. His prize: \$7,500. His spark plugs? Autolite. Lee Roy

Yarbrough tools a modified '56 Ford to first place in the 250-mile National Championship Modified and Sportsman Stock Car Race. His record speed: 146.723 mph. His prize: \$4,800. His spark plugs? Autolite. Every single big race at the 1962 Daytona Speed Weeks fell to Autolite spark plugs. Like a little extra power in your car? Give Autolite spark plugs a try next time. You'll be traveling in rather distinguished company.

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"I'd like to see them make..."



A roll-up patio roof housed in a rustproof cylinder. In summer, you'd mount it on a house wall, pull it out, and prop it up. In winter it'd lift off for storage — *W. E. Selter, Lutherville, Md.*



Better cooking pots to give south paws a break. Why not put pouring lips on both sides of utensils so they'd be easy to use by right- or left-handers? — *Marjorie Hall, NYC.*



Road maps on microfilm and a tiny viewer in the dashboard. Only a little of the map at a time need appear on the screen. — *G. A. Mayerchuk, Brooklyn Park, Minn.*



Windproof cigarette holders for convertible owners. A funnel-shaped holder with side vents and a lid might slow combustion to give a normal smoke — *G. Nuttall, Brooklyn.*




A chemical hardener for earth fill so you could pour it into a double-walled blow-up mold and make an adobe-like shelter — *F. M. Scott, Leonia, N.J.*

Everyone has his own idea of a gadget that he would like to see in general use. What's yours? We will pay \$5 for each one published. Please use Government postcards.

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I Rode Our Hottest Jet

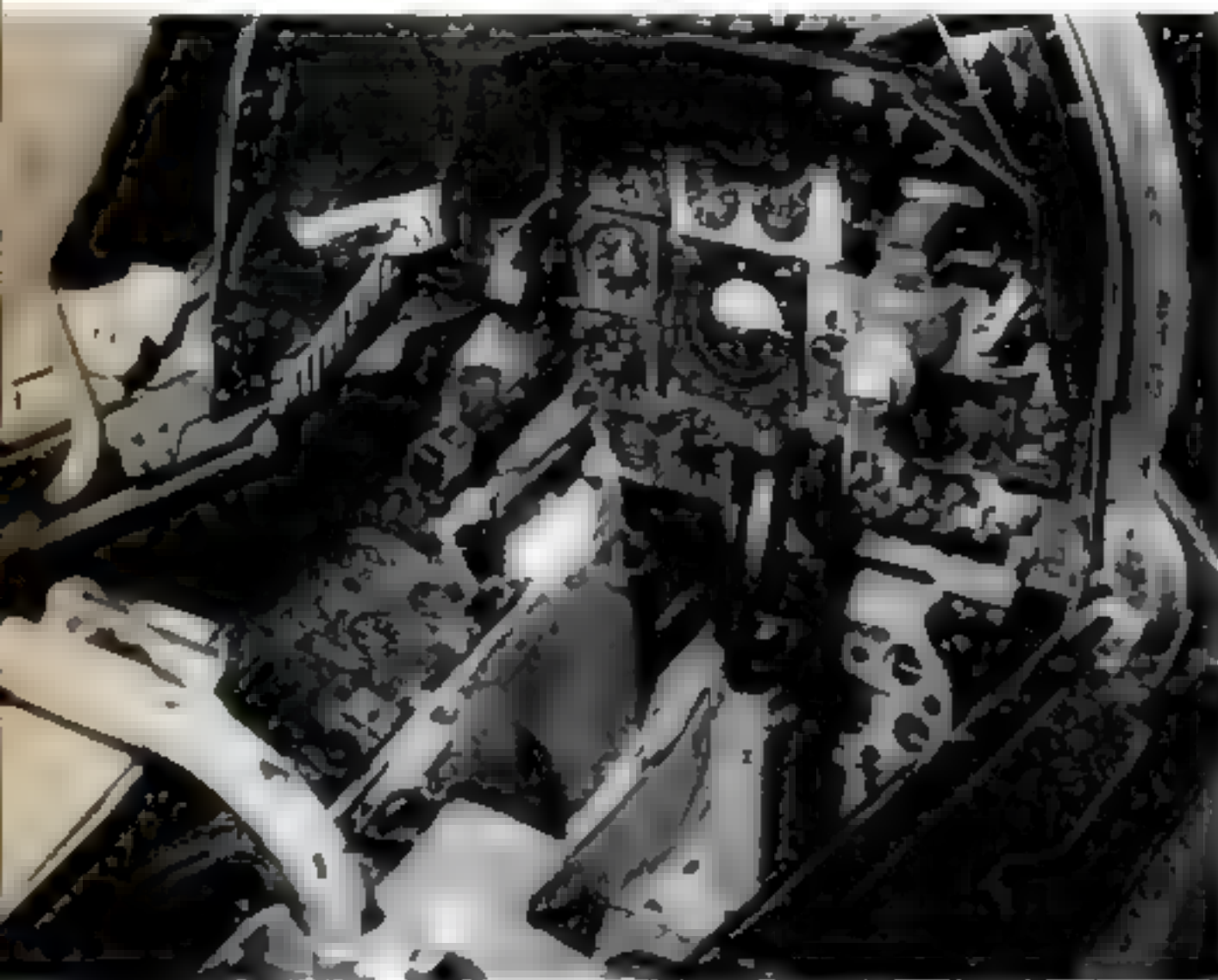
By Frank Harvey



"A straight-up takeoff," I said. "Let's try to beat Mach II." It should be a breeze, I figured, in the Navy's new Phantom II jet fighter-bomber. This double-threat bird zooms up at 20,000 feet a minute, shatters all speed records, can carry anything from napalm to hydrogen bombs, and comes equipped with the fanciest antijamming and intercept radar ever. Yet

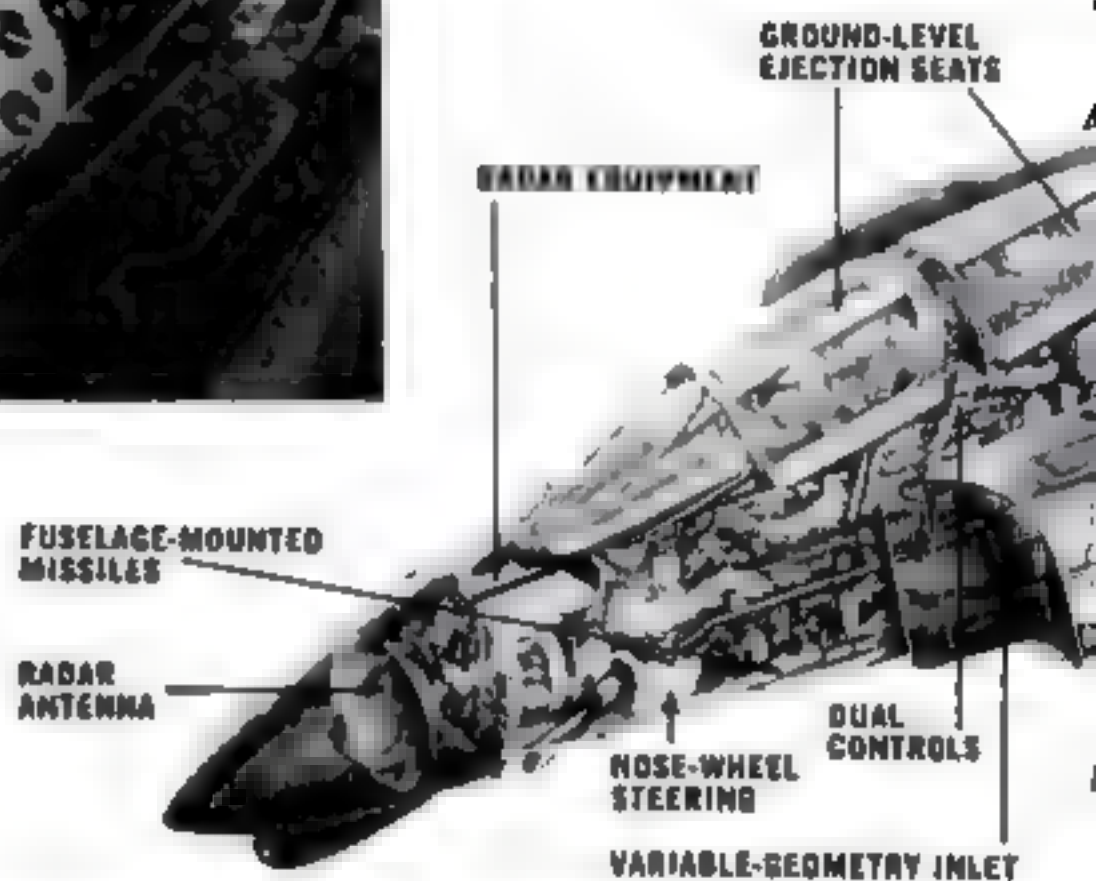


She can fight like the devil and run like hell, but to her crew she's

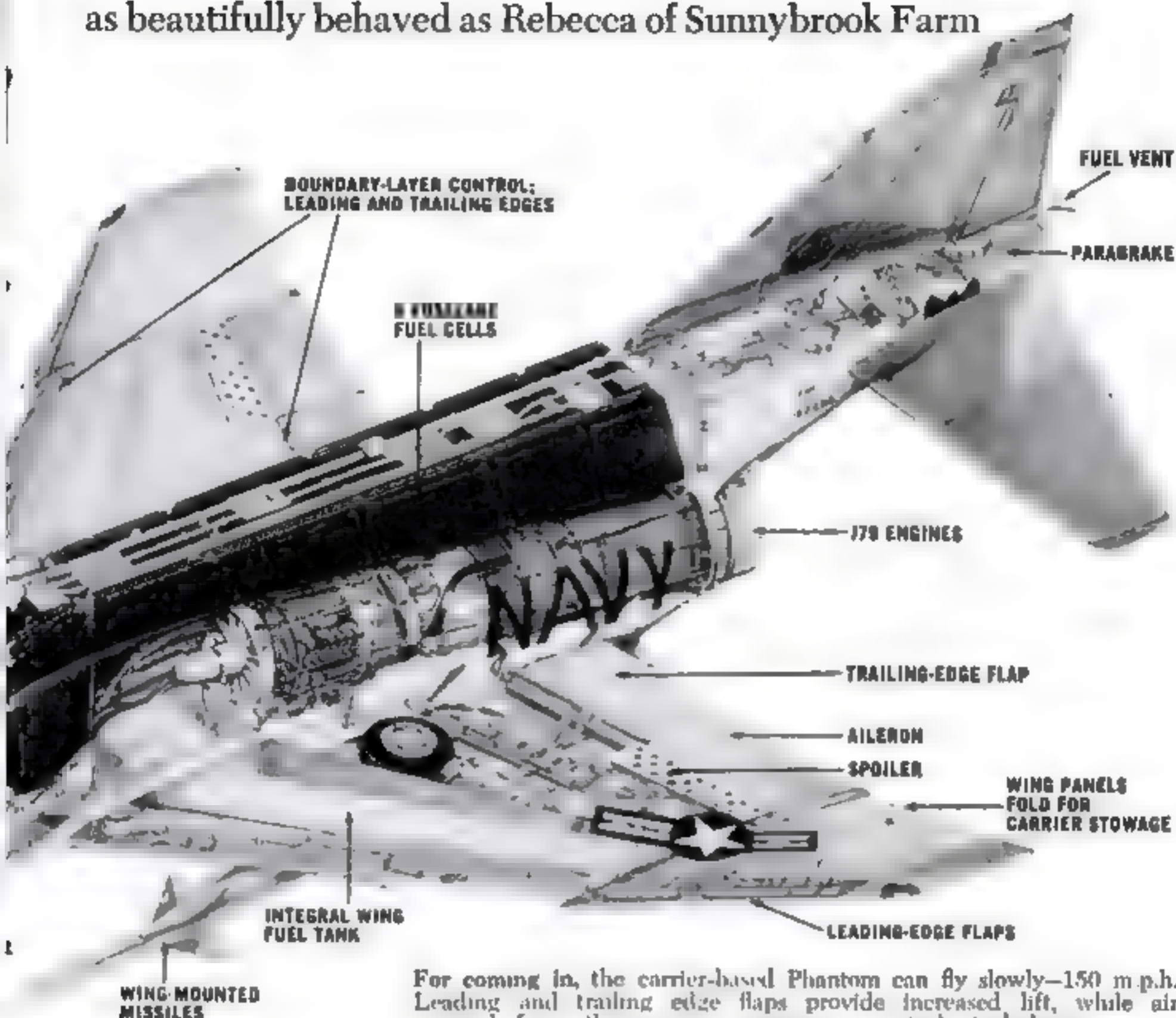


Forward cockpit of F4H has just squeeze-in room for pilot. (Radar man rides aft) Left of center above altimeter is Mach indicator. Emergency canopy-jettison control is left of seat.

Lethal loads: Sparrow III and Sidewinder missiles perch under the wings and fuselage. She can also tote A-bombs.



as beautifully behaved as Rebecca of Sunnybrook Farm



For coming in, the carrier-based Phantom can fly slowly—150 m.p.h. Leading and trailing edge flaps provide increased lift, while air pumped from the engine compressors controls turbulence

she's so gooney looking I wondered how she could ever get off the ground.

Her beaklike nose droops out of a barrel belly. Her wings bend up at the tips. Her fin is about as graceful as a homemade weathervane. A little kid seeing the plane for the first time screamed excitedly, "Look, Mom, they got the tail on upside down!"

Double threat. But McDonnell Aircraft, makers of the Phantom II, couldn't care less. The plane happens to be the hottest jet in the world. So impressed is the Tactical Air Command that they're thinking of buying 500 Phantoms—at \$2 million apiece. The reason? The plane's versatility. She's a long-range bomber. She's a fighter—the toughest, fastest in-

terceptor we have. And count these among her laurels:

She holds the low-level speed record: 932 m.p.h. on the deck over the Mojave Desert in a run aptly called "Sageburner." And the altitude speed record: 1,606 m.p.h. (Mach 2.55). She can also sustain herself in level flight above 66,000 feet, then zoom to over 98,000.

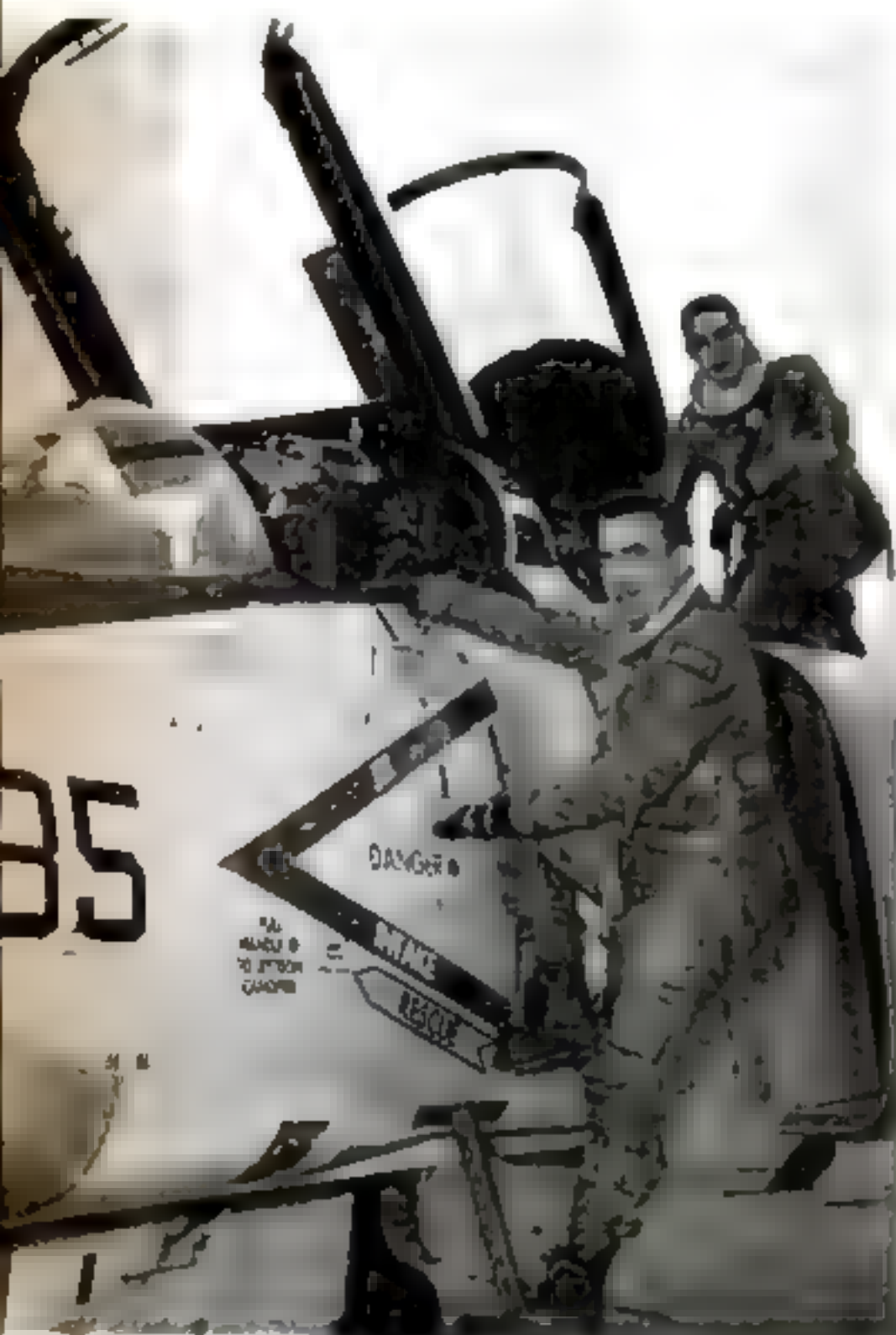
She is impressively long-ranged, can refuel in mid-air, and take off and land in about half the distance of jets with half the speed, a fact that suits TAC—as well as the Navy—to a T.

The clincher, as far as the boys who handle her are concerned, is that the bird is as beautifully behaved as Rebecca of Sunnybrook Farm. She forgives mis-



Ugly is the word for this blunt-end view of the Phantom II. With her wing panels slightly

raised, the \$2 million bird looks more like a monster blowup of the common house fly.



Lt. Cmdr. L. Scott Lamoreaux (left) put the F4H through its paces while author Harvey rode the back seat—a spot normally occupied by Radar Intercept Officer Lt. Thomas Johnson (right).

takes that lesser jets would kill you for; has no little cantankerous tricks like her sister the F-101 Voodoo (which will nip up and start doing flips if you horse her just a weenie bit too hard on takeoff).

De-jamming the jammers. But even that's not the best news. The Phantom II has the deadliest radar of any jet fighter in the country. Enemy bombers switch on jamming gear that showers the radar sets of most interceptors with jiggles, squiggles, spokes, and shimmies. But not the Phantom's scope. Her new General Electric-designed radar actually homes in on the jammer. When a certain dot is safely corralled, and the "in-range light" comes on, the radar operator turns the kill over to the pilot. The pilot squeezes off a Sparrow beam-rider or a Sidewinder heat-seeker, and the enemy threat becomes a large cloud of assorted

[Continued on page 190]

Maximum speed in level flight: 1,606 m.p.h.
Rate of climb: over 20,000 feet per minute
Ceiling: 98,557 feet in a zoom
Sustained altitude: 66,000 feet
Thrust: 32,500 pounds from two improved General Electric J-79 engines
Dimensions: Overall length: 58 feet 3 1/2 inches
Wing span: 38 feet 4 9/16 inches
Distance to top of fin: 16 feet, 3 inches
Records: Low-level speed record: 932 m.p.h.
Closed course 100-kilometers: 1,390.2 m.p.h.
Closed course 500-kilometers: 1,216.8 m.p.h.

How Typewriters Give Criminals Away



Private typewriter-detective Martin Tytell, assisted by his wife, examines specimens of typewriting in his New York laboratory.

Forgers, blackmailers, cranks, and con men often unwittingly type their tickets to jail

By Richard Petrow

THE bomb came wrapped in brown paper. Addressee: a coed at a Midwestern university. Sender: unknown. It exploded with vicious force in a dormitory room crowded with girls. Seven were injured.

When Lt. Edwin C. Schroeder of the Indiana State Police arrived, college officials handed him a few bits and pieces of jagged wood and metal—fragments from the bomb itself—plus a neatly typed address label that had been pasted on the package.

Schroeder accepted the typewritten label with satisfac-



More revealing than handwriting, typewriter letters differ widely from make to make. There are more than 20 kinds of "g"s, five are shown enlarged.

A typed page can be better evidence than a fingerprint, and

tion. As an expert in questioned documents, he is one of a small band of criminologists who are becoming increasingly successful in tracking down criminals who use typewriters in the commission of their crimes.

a a a

"The label was examined to determine the make of the machine," Schroeder explained. "It was an L. C. Smith, pica type, old model."

Schroeder's task: to find the machine that had typed the label. On a hunch he started looking around the university.

m m

"We finally found it within arm's reach of the girl's former boy friend," Schroeder said. "He confessed after we confronted him with the typewriter evidence."

What was the evidence? Said Schroeder:

W W W

"The label had been typed on a machine that had a funny looking 'g' with a nick in the lower loop, an 'l' that hit at an angle, and a 'p' with a circle filled with typewriter debris."

i i

"The boy friend's typewriter had the same funny 'g,' the same cockeyed 'l,' and the same smudgy 'p.' It was almost as if he had signed his name."

No two alike. Solutions to cases such as this one, Schroeder added, hinge on the fact that each typewriter has individual characteristics. Typewriter experts also know that no two makes of typewriters have the same type face.

a a a

A Royal, for instance, uses different type than an Underwood, and so on down the line, for both American and foreign machines.

f f f f

Typewriter experts know this, but Joseph N. Bollettieri didn't.

S S

Bollettieri is the former superintendent of streets in Utica, N. Y. Today he's an inmate of Attica Prison.

"Bollettieri tried to get away with using city funds to buy material for some personal home-improvement projects," explained Robert E. Fischer, Special Assistant Attorney General for the state of New York. "He's in jail now because he didn't know that the numeral '2' on a Royal elite has a straight base, while an Underwood '2' has a curved base."

In court, Bollettieri argued that the requisitions for the material that eventually wound up in his home had been routinely processed in a different department—the Department of Public Works. He insisted he had nothing to do with them.

"When our typewriter expert, Louis A. Waters of Syracuse, examined the requisitions," Fischer continued, "he noticed many curious things."

Some of the "5"s had a small arc on top, a characteristic of old Royal elite machines. Other "5"s did not; this is

Blowups of letters pinpoint characteristics that often identify the machine used. In center, "i" dotted to left of vertical stroke is L. C. Smith. At bottom, small-top "s" is Royal.

the story it tells hold more drama than a novel

characteristic of Underwood elites. Some of the "w"s had center strokes that went right up to the top of the letter (Royal), other center strokes stopped well below this level (Underwood). Some of the "8"s had elliptical lower loops (Royal); other "8"s showed circular loops (Underwood).

Obviously, two machines had been used to type the requisitions—a Royal and an Underwood.

The clincher. "When we checked City Hall," Fischer said, "we found the Royal in the Department of Public Works, and the Underwood in Bollettieri's department. His defense that he had nothing to do with the requisitions couldn't be maintained. A lot of other evidence linked the defendant to the crime, but I'm convinced the typewriter evidence clinched the case."

Most law-enforcement agencies have one or more document examiners on staff. But the services of typewriter sleuths are also available to ordinary citizens.

Consider the case of metalworker Tom Robinson (the name is fictitious), who was injured on the job through no fault of his. The accident left him with no job, an injured left leg, and a lawsuit. He was suing his former employer, but his case was not going well. Opposing attorneys had a document in which he supposedly waived all claims. The document was valid, except for one paragraph. That paragraph was a typewritten forgery.

"I'm granting a two-day postponement," the judge barked. "If you can't prove it's a forgery, I'll throw your case out of court."

That afternoon, Robinson found himself telling his story to Martin Tytell, a private typewriter-detective with offices in a cluttered loft building in downtown Manhattan.

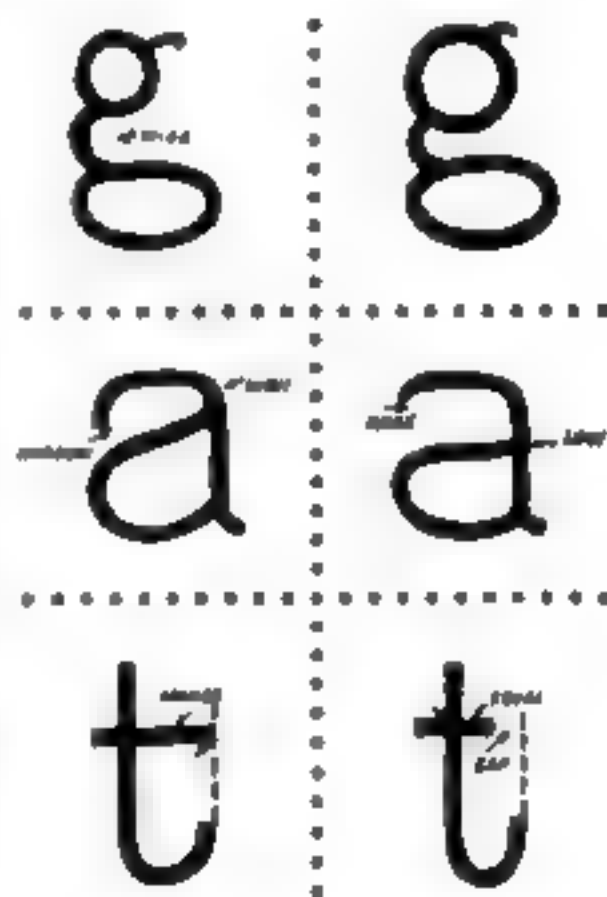
Robinson recalled that he had signed an injury report form for an insurance adjuster. But when the paper was produced in court, it had a new paragraph. In it, Robinson admitted his negligence and waived all claims.

"Arrange for me to see the document," Tytell said.

Tytell soon had the questioned document before him. A painstaking examination convinced him that the paragraph in question had been typed on the same machine as the rest of the document.

But as he examined the material under oblique light, he

[Continued on page 200]



Crime clues: In the case of the forged warehouse receipt described in text, everything hinged on when receipt was typed. Letters on right could not, as claimed, have been typed in 1943, since Royal did not change over from left-hand letters until 1945.

Idiosyncrasies: Not only do different makes and models of typewriters print differently, but after some time in use, individual machines develop peculiarities. Below is an example showing how certain letters get a little cockeyed—are no longer centered on line.





USAF
AFSWC

NMPO



World's Biggest Robot

Fix an atomic rocket engine? Clean up spills of radioactivity? Rescue H-bomb victims? That's what the Beetle is for

By Martin Mann

THAT monster glaring at you from the left is the biggest robot ever made. It weighs 170,000 pounds in its double-thick rubber treads. It can punch its claw hand through a concrete wall or gently stretch stainless-steel arms to pluck an egg off the top of a house.

There's a man inside. Safe within the lead-and-steel cab, he can work where no unarmored man could live—in the deadly radiation that makes atomic energy the most fearsome as well as the most promising invention of the century. He could roll right up to the atomic engine of a space rocket and, delicately maneuvering those 16-foot arms, make adjustments. Or he could replace a broken part in the atomic boiler of a power plant. Or haul the fatally hot debris of a nuclear accident away to the burying ground. If H-bombs struck, he could dash into the destruction zone to rescue injured people and scrape away the worst of the fallout dust.

That's what this bizarre machine, named the Beetle, can do. When PS Chief Photographer Bill Morris and I first saw the Beetle, it wasn't doing anything but sitting on a hangar floor. They couldn't start the engine

PHOTOS BY W. W. MORRIS

Quartz-tube floodlights blazing, the huge Beetle swings mechanical arms high above its tanklike chassis. An A-frame hoist will be added later to lift loads too heavy for the arms.

CONTINUED

Beetle is first of a family of robots that will handle the hot jobs of



Man behind the arms: Tex Scraper, who will put Beetle through tests at Jackass Flats, Nev., climbs into cab. Over his head is 7½-ton hatch that slides down to seal him inside.

Robot with a bellyache. In four days it operated seldom, and then it limped more than ran. There was difficulty with the degassing circuit. A plug popped and hydraulic fluid squirted out (a dedicated engineer, Dutch-boy-like, stuck his finger in the hole). A diode blew, immobilizing one arm (a welder had dropped a tool into the control chassis). The auxiliary generator pooped out (brush trouble). It seemed that short circuits had their own short circuits (after all, there are 400 miles of wiring in the thing).

Such bugs are standard equipment in any complex new machine. They were cleaned up in a furious week of round-the-clock troubleshooting. But these setbacks were only the culmination of troubles that dogged the Beetle from the beginning. It was originally designed to be a robot mechanic for the atomic-powered airplane, a star-crossed project that stumbled through 10 years and \$500,000,000 without ever getting off the ground.

So the Beetle is an orphan. The Air Force, which paid \$1,500,000 for it, still isn't sure exactly what it will be used for. Yet the need for machines of this type is so certain that the orphan is already fathering a whole family of newer robots. The next models, now on the

Climbing, turning, swinging

Beetle demonstrates its agility. It was built by General Electric for the Air Force Special Weapons Center



the atomic age

Inside looking out, operator gets a fairly broad view. There are five windows: this large one in front and two on each side. Each window is laminated from seven sheets of leaded glass to give a total thickness of two feet. That makes radiation shielding equivalent to a foot of lead. Despite their thickness, windows are clear, though tinted a definite yellow.



drafting boards, will bear only a family resemblance to Papa Beetle. They'll be smaller and lighter, so they can be air-lifted where needed. Most will be remote-controlled—without a man inside you don't need all that heavy radiation shielding.

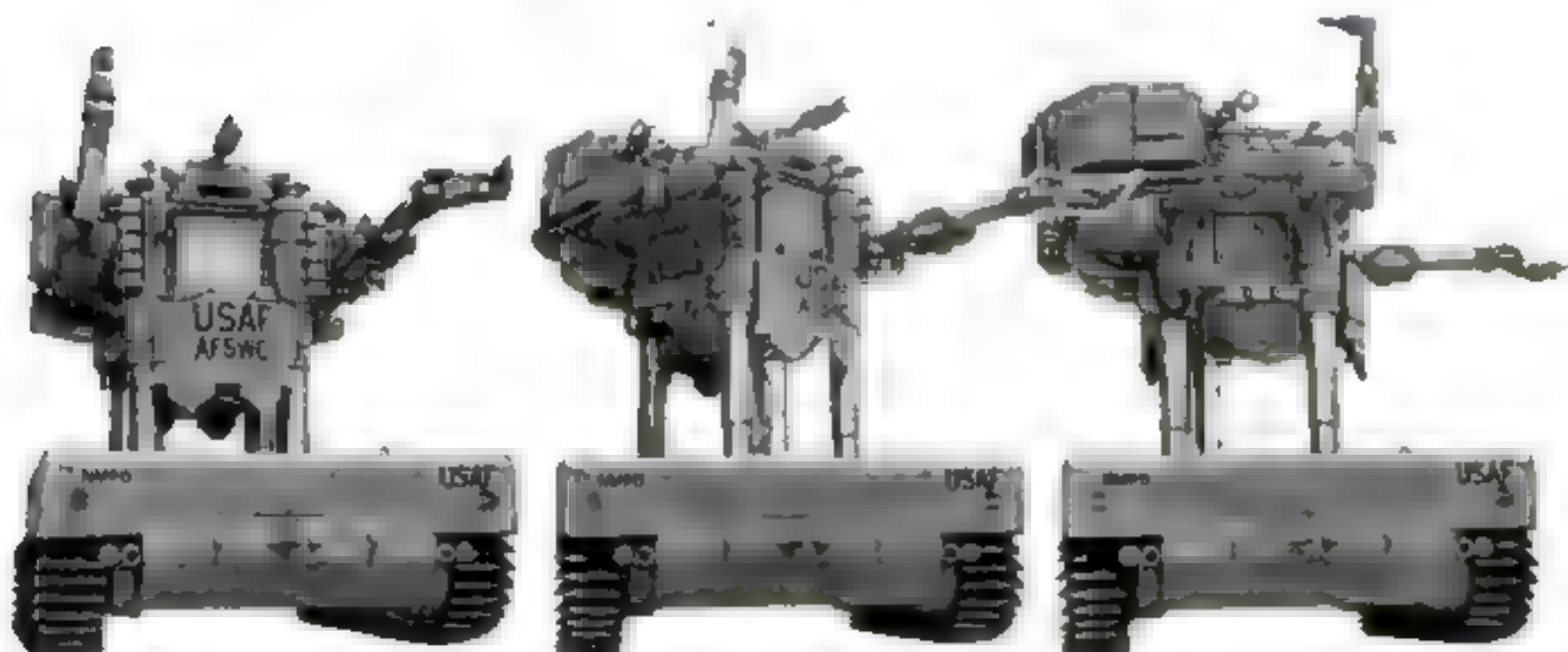
The Beetle does carry a man. That makes it more versatile. But it also requires some of the most elaborate engineering ever lavished on any ground vehicle.

It looks like a tank. That's because the chassis is reworked from an Army

M42 40-mm. gun carrier. A 500-hp. supercharged Continental six speeds it along roads at 10 m.p.h., but there's also an electrical drive by which it creeps 15 feet per minute. It could wrench the concrete wall off a test cell without grunting hard—drawbar pull is 85,000 pounds.

The cab, however, is nothing like a tank turret. It not only turns around and around, but moves up and down 15 feet on four stainless-steel legs (built like hydraulic auto lifts). These movements

[Continued on page 203]



Zero to 60 in six seconds . . .

Test-Driving Detroit's Stock-Car 'Monsters'

PS reporter applies a heavy foot to three real screamers—the 400-hp. Ford, Chevy, and Pontiac

By Alex Markovich

THE monsters have come. But unlike the bug-eyed Martian variety, these were hatched right in Detroit. They're the latest crop of super-engines.

Each packs a displacement of over 400 cubic inches—and horsepower to match. Even now, disguised as innocent-looking Fords, Mercurys, Chevrolets, and Pontiacs, they're infiltrating our roads and dusting off all comers.

Who buys these bombs? Police forces make up a sizeable market. Professional stock-car racing drivers buy a few. Hot rodders, of course, are lured by the happy vision of making a smoky exit from their favorite drive-in. And there

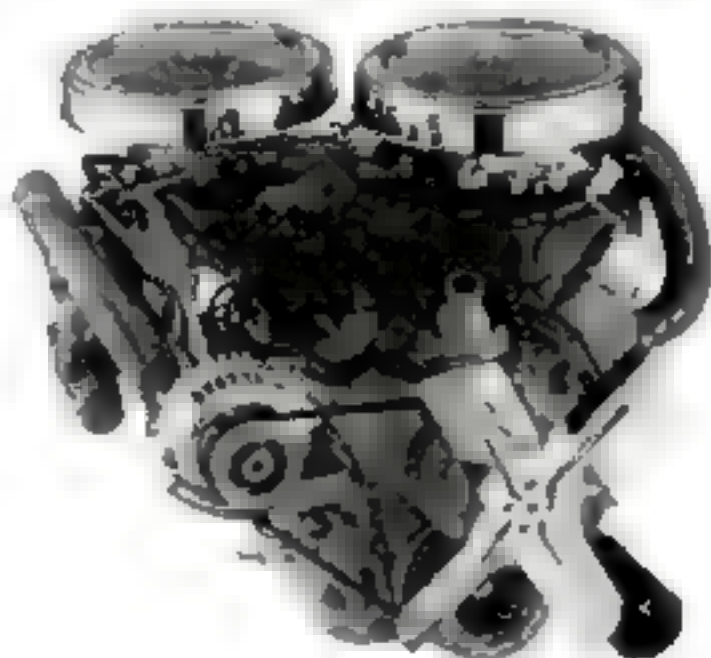
is the balding family man who never drives over 50 but insists on owning the fastest.

Ford, Mercury, and Chevrolet high-performance models can be bought by anyone with enough cash and the patience to wait a few weeks for delivery. Pontiac, though, feels that letting Aunt Millie drive their big-engined car would be like giving Junior an H-bomb for his birthday. They restrict sales to police and competition drivers.

Being a hot-rodder at heart, I needed our editor until he let me go to Detroit to test-drive the monsters. First stop was Dearborn, where a big, mean Ford Galaxie was waiting.

Fastest Ford ever made. Yanking open the hood, I expected to see a

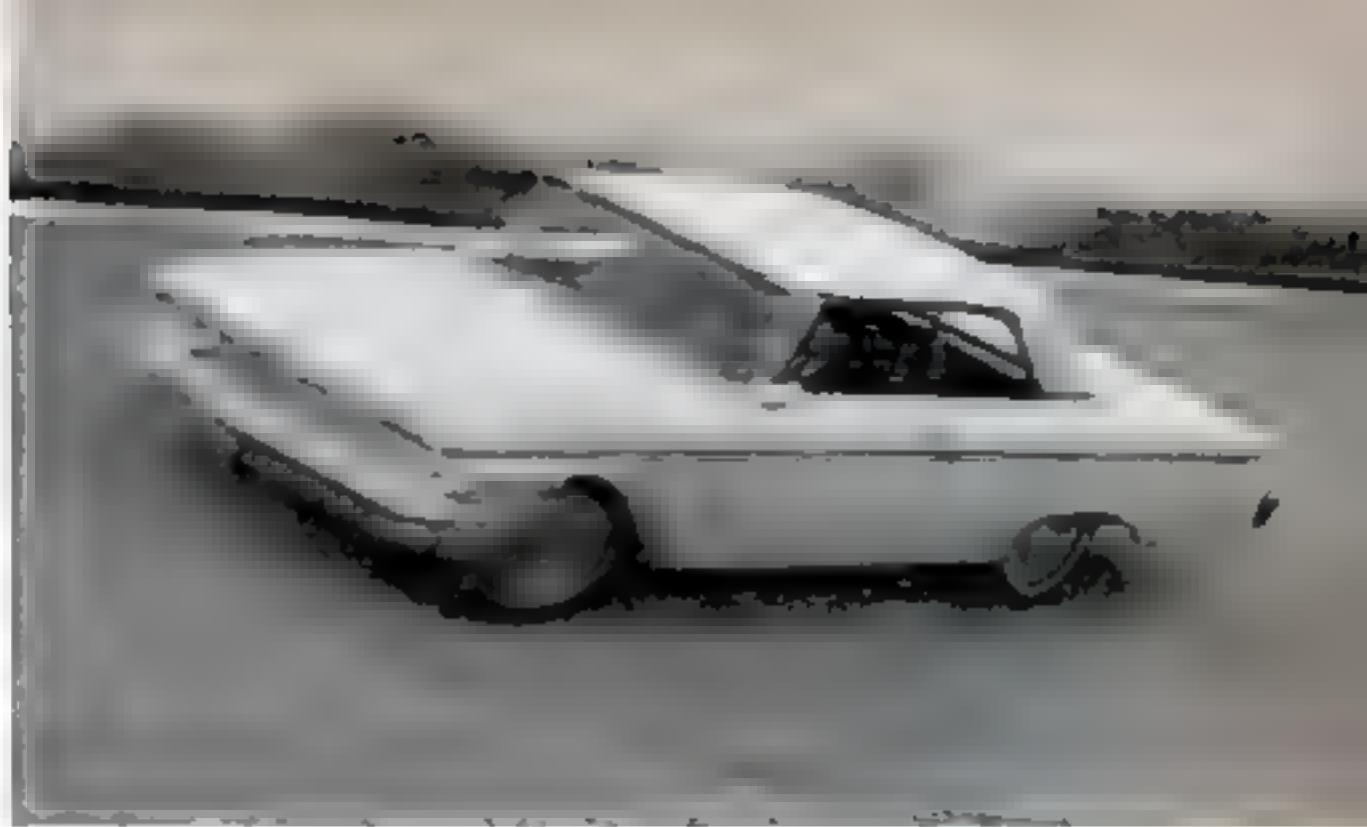
Chrysler Corporation's 413: Latest Contender in the Cubic-Inch Race



A 410-hp. version of the 413 mill for Chrysler, Dodge, Dart, and Plymouth was announced too late for a driving report. But on paper this engine is a serious threat to the rest of the superstockers. Bore and stroke are 4.19 by 3.75 inches, totaling 413 cubes. It develops up to 385 hp. at 5,200 r.p.m. in factory trim; a dealer-installed dual-quad ram manifold raises this to 410 hp. at 5,400 r.p.m. The hottest combo is the 413-plus Plymouth; it's comparatively light and it offers a long list of optional dealer-installed speed equipment (made by outside manufacturers but qualifying as stock). This includes three-carb manifolds, domed pistons, high-speed camshafts, mechanical lifters, and heavy valve springs to prevent float.

Ford

Slippery banked track didn't bring out any quirks in handling, but the optional faster steering (less than four turns lock-to-lock, compared with standard five) would have been welcome at high speeds. The 15-inch wheels allow bigger brakes and give a smoother ride. Tires last longer, too.



gleaming beast beneath. But the engine looked almost like the old 390. Its 406-cubic-inch displacement came from an enlarged bore, 4.13 inches against the smaller engine's 4.05. Stroke remained at 3.78.

The big visual difference was in carburetion. There, perched atop the engine, were three two-barrels. A less obvious clue to the engine's identity was a set of the smoothest exhaust manifolds ever seen outside a speed shop.

The innards also were reworked extensively. Compression ratio is a whopping 11.4:1. The camshaft has a different profile, but it's mild enough to permit a fairly smooth 700-r.p.m. idle. Hydraulic lifters are replaced by mechanical ones.

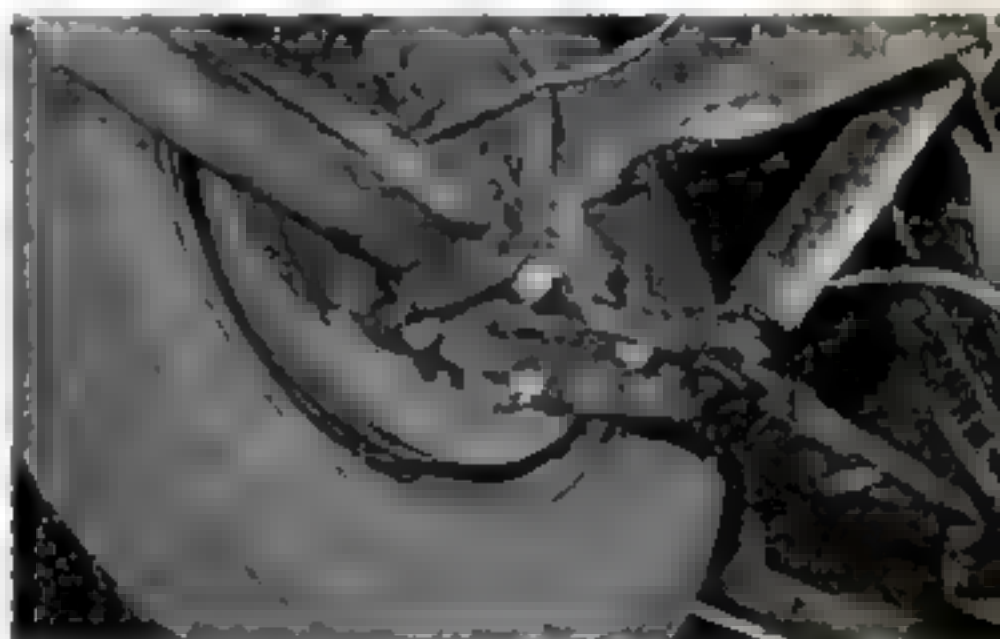
The rods have heavier flanges and are X-rayed before installation. Oil galleries are enlarged and a larger-capacity oil pump is used. With the recommended superpremium gas, the engine develops 405 hp. at 5,800 r.p.m. and 448 pounds-feet of torque at 3,500 r.p.m. The optional tachometer is red-lined at 6,000—really screaming for so big an engine.

For competition use, still more options are available. These include forged pistons, dual valve springs, a bigger radiator, a four-blade fan, an oil cooler, and a seven-quart oil pan (the stock one holds five).

No slush boxes. No amount of pleading with your Ford dealer will get you a 406 with automatic transmission. The Fordomatic simply won't take the 406's



Removal of air cleaner on Ford 406 shows six barrel carburetion (really three two-barrels packed together tighter than suburban development houses. Secondary carbs kick in at about 40-percent throttle. High-performance option costs \$579.70 over 292-cube V-8

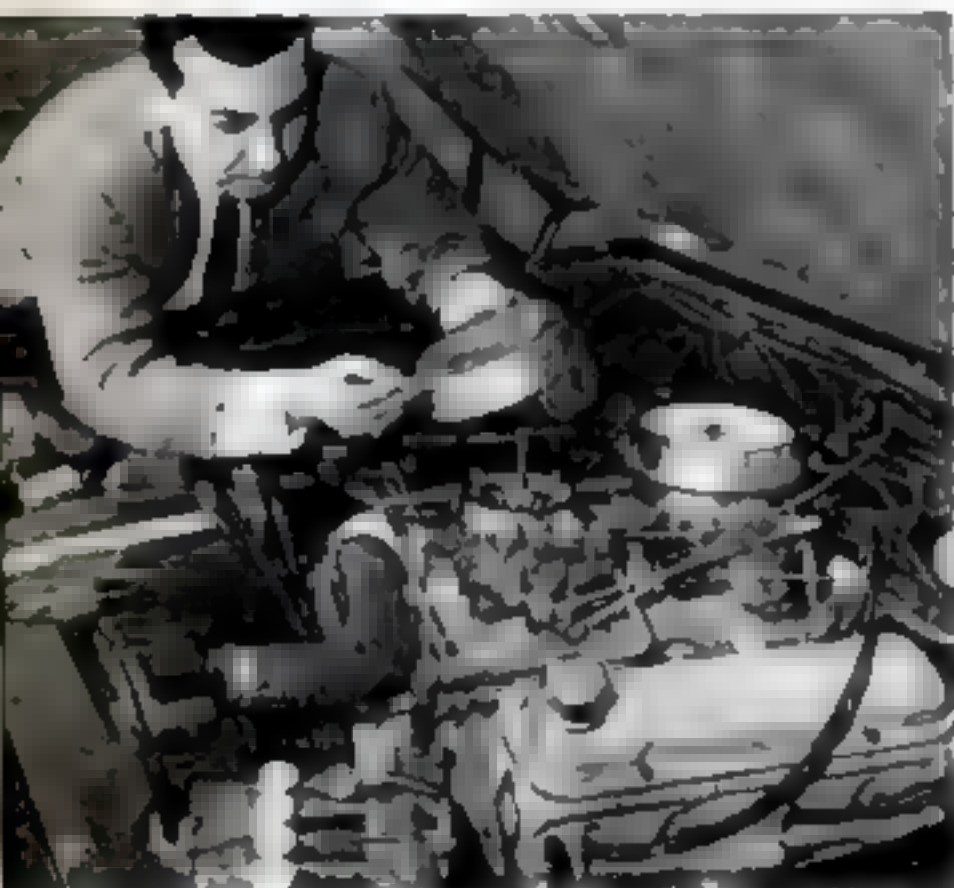


Extra spring leaf on each side helps tame the torque. The shocks are heavier and stiffer. The front coils also are heavier. Ride rate is raised 25 pounds-inches front and rear, but even so the ride isn't objectionably firm.



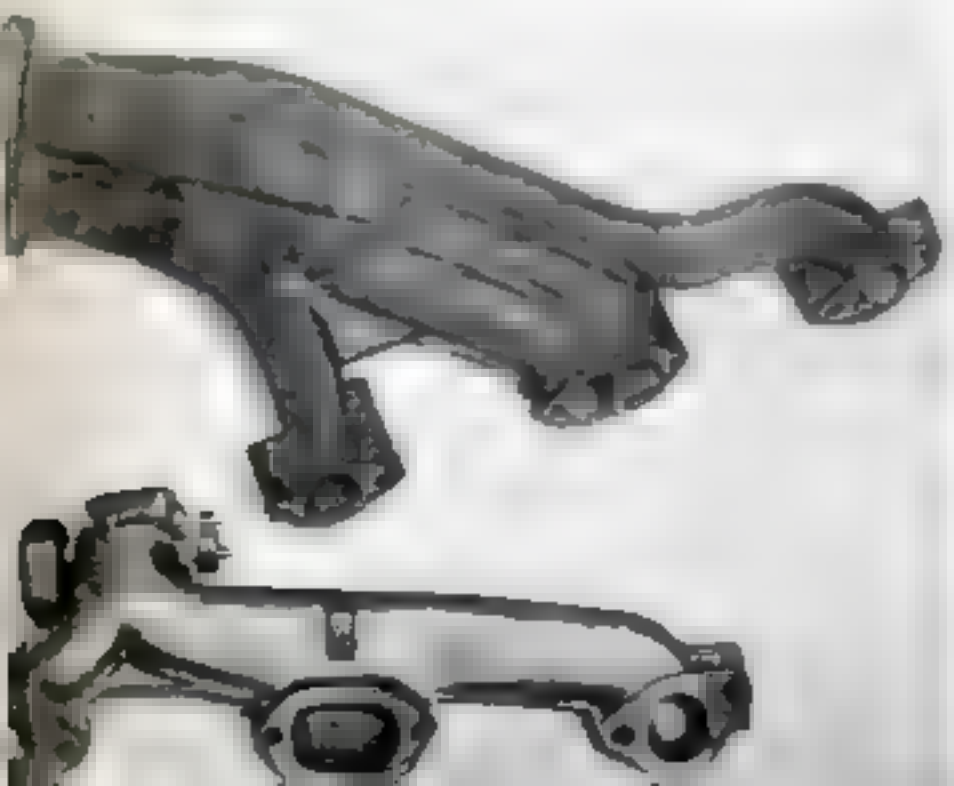
Pontiac

Though stiffer springs are available, our test Pontiac had standard setup—adequate but slightly mushy. A fast, uneven idle, touchy clutch, and brash exhaust note—to the car buff—make up much of 421's charm. With a flashing red light on its roof, watch out.



Most powerful production engine made is in Pontiac, which gave fastest acceleration figures of all. Tiny air cleaners are one of the indications that the 421 means business. Too bad the engine isn't readily available.

High-performance Pontiac exhaust header (below) compared with standard manifold (at bottom). Smooth, straight pipes, a separate one for each port, are more expensive to manufacture but they net several extra horses.



torque. The standard gearbox is a column-shift three-speed (a floor shift is optional). For the connoisseur, there's also that wonderful all-synchro four-speed by Borg-Warner—basically the same used by Corvette, Chev, Buick, Studey, Pontiac, and Olds. Two other gadgets you can't get with the 406 are power steering and power brakes.

Ford believes that a car with 405 horses on tap should have better-than-average handling to be safe. Up front are thicker coil springs; the rear end has five-leaf springs instead of the usual four. The bore of the 406's shocks is 3/16 inch greater and valving is considerably stiffer. Fifteen-inch wheels (which allow better braking) and nylon tires are standard. Steering is unchanged with a slow 30:1 overall ratio, but optional linkage can be hooked up to reduce this ratio to 22:1. This is recommended only for racing, however, since at low speeds it would take more steering effort than a mad elephant. For greater safety, a three-inch-thick drive shaft is standard.

Wringing it out. Enough pussyfooting, I thought. Bill Morris, our photographer, had exercised his shutter finger to his heart's content. Now for a test drive.

I slid behind the wheel and twisted the ignition key. The growl from the pipes almost made me feel like the incapable Aunt Millie Pontiac was worried about. Bill, sitting beside me, nervously snapped on his seat belt.

I shoved the four-speed stick into first

Chevrolet

Standard suspension on our test Chev made navigating the wet, banked track a bit hairy. But with optional police-taxi heavy-duty suspension, the car's entire personality changes. The 409 engine is available in all Chevrolet full-size lines as well as in all body styles



and diddled the gas pedal. The clutch bit smoothly and positively. I wouldn't go so far as to agree with those Ford ads that say your wife won't know the difference, but the car was quite docile at low speed, the ride pleasantly firm.

Sharp bend coming up. Rain-slicked pavement. Surprise. That Ford stuck to the track like chocolate to a baby's fingers.

I handed the stop watch to Bill Morris. "Zero to sixty," I said, revved to 2,000, and popped the clutch. The tires spun and trailed two ugly black streaks. But almost immediately the engine bogged down. It was loading up and that high 3.56 rear end didn't help.

The car quickly recovered, and we ran it right up to 60 in first gear. Time was 8.2 seconds—impressive, but I knew the car could do much better.

Second time out I revved to 2,500 and slipped the clutch. The carburetion still wasn't happy, but our time dropped to 7.6 seconds. Ford engineers later told us that, properly tuned and with a 4.11 rear end, the car could easily whisk off 0-60 in well under seven seconds, even though with a lower rear end an upshift would be necessary.

Top speed? The track was too slippery for an all-out run. But a stock 406 did set an unofficial lap record of 138.2 m.p.h. at the Atlanta International Raceway. This would put top speed at way over 150.

[Continued on page 206]



Basically a hogged-out 348-incher, the Chev 409 is available with two four-barrel carbs (as on our test car) or a single four-barrel, which cranks out 380 hp. Only a few 409s were made in 1961. This year's crop has new heads, valves, pistons, and intake manifolds, as well as larger ports for better breathing.

Educated right foot is necessary for controlling Chev's wheel spin at breakaway. Engine develops so much torque that at speeds of about 25-40 m.p.h. it's just as happy in any of the four forward gears for normal driving.



Drag balloon to brake missile descent

A self-inflatable balloon nine feet in diameter is being tested by the Air Force for its ability to cause drag and slow down the descent of large missiles from supersonic speeds, and thus aid in the recovery of space-research instruments.

The drag device, called a Ballute (for balloon-parachute), has been tested in drops from nearly 20 miles. Packed in the tail of a 500-pound missile, the Ballute is

released and inflated at 88 000 feet to brake the 750-foot-per-second fall. At lower altitudes, a regular parachute takes over to cushion the landing.

Goodyear is developing the recovery system for rocket-booster assemblies, research vehicles soaring as high as 200,000 feet at speeds approaching 10 times that of sound—and perhaps to brake manned emergency escape capsules.



1. Ground test: Ballute is packed in crate.



2. It pops out, splits container as it puffs up.



Motorized Army band

With a jeep for each instrument, the Fourth U. S. Armored Division's brass band provided music (at left) for a parade of 3,400 Army vehicles at Grafenwoehr in West Germany, near the Red border. The conductor faced his musicians, standing on a platform placed over the back seat of a jeep.



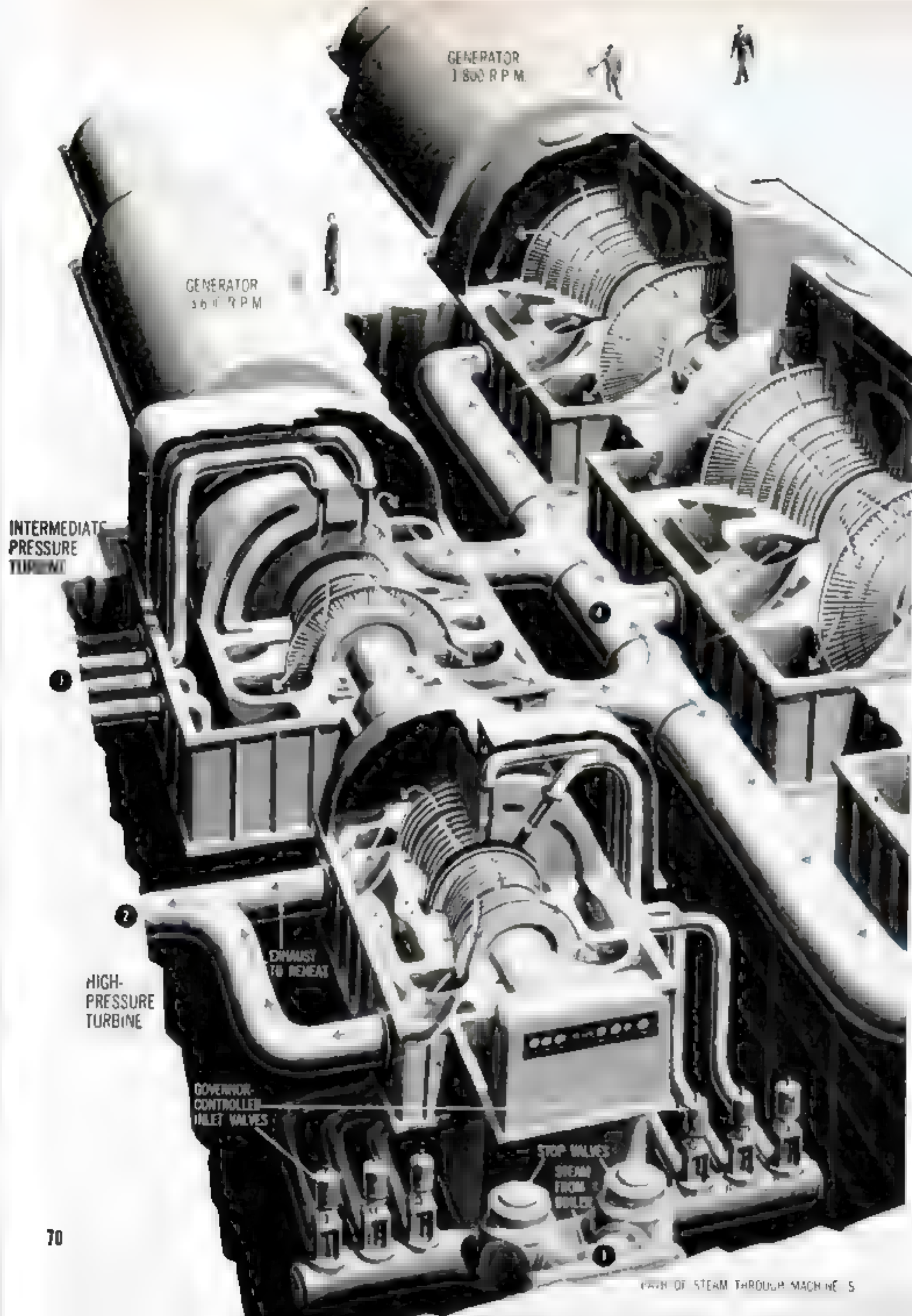
3. Free of container, it rapidly takes shape, inflating fully in a tenth of a second.

Truck with transom

A hinged roof panel on the new Renault Fourgon delivery truck provides loading access for tall cargoes and extends carrying capacity for ladders and other overhanging items. With flap lifted and rear door open, there's walk-in head room.

The truck is based on the front-wheel-drive Renault 4L, has a sealed cooling system, bolt-on body sections, and torsion bar suspension.





GENERATOR
1800 R.P.M.

GENERATOR
3600 R.P.M.

INTERMEDIATE
PRESSURE
TURBINE

HIGH-
PRESSURE
TURBINE

GOVERNOR-
CONTROLLER
INLET VALVES

STOP VALVES
STEAM
FROM
BOILER

PATH OF STEAM THROUGH MACHINE

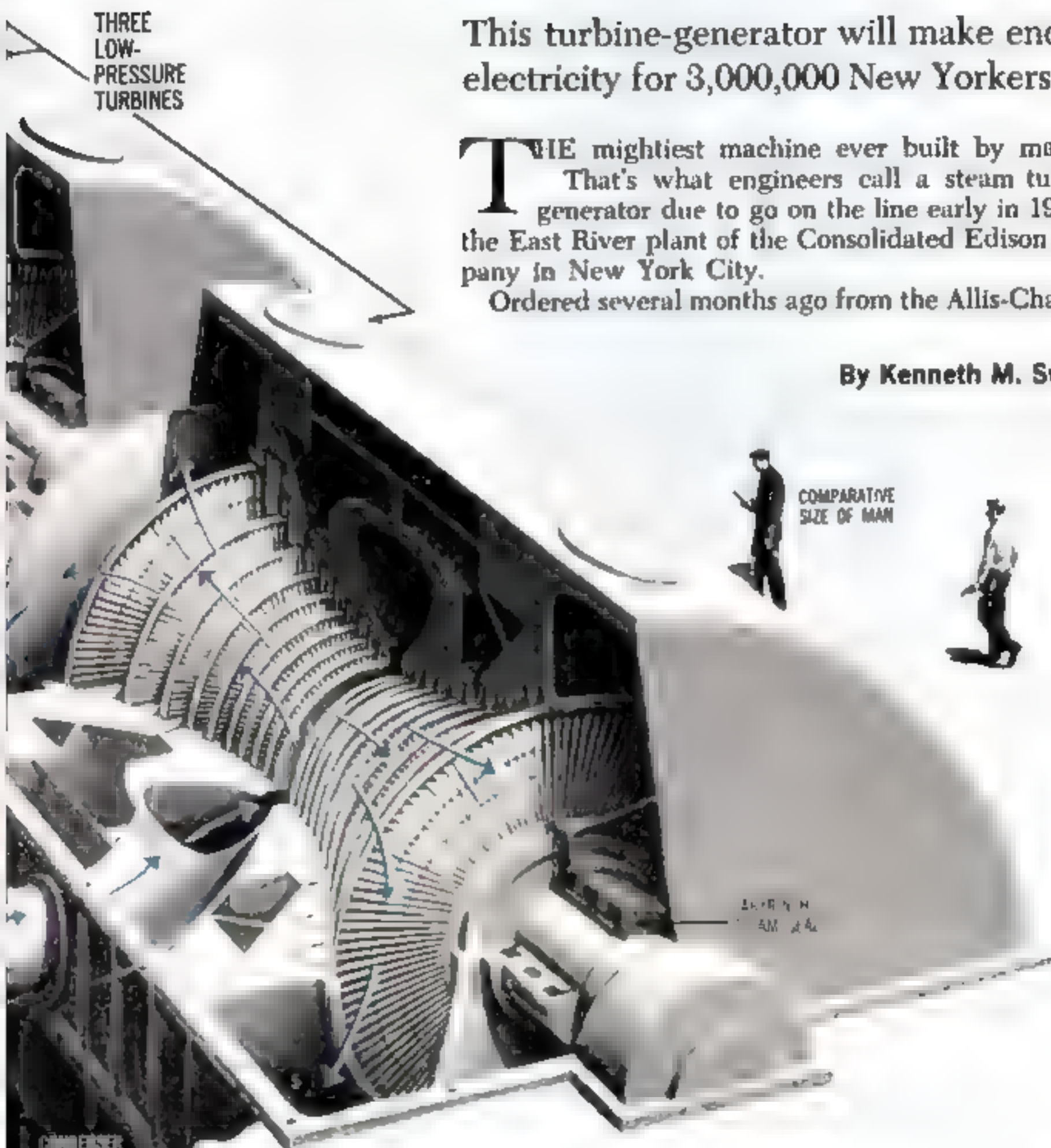
Man's Most Powerful Machine: 1,400,000 Hp.

This turbine-generator will make enough electricity for 3,000,000 New Yorkers

THE mightiest machine ever built by man! That's what engineers call a steam turbine-generator due to go on the line early in 1966, at the East River plant of the Consolidated Edison Company in New York City.

Ordered several months ago from the Allis-Chalmers

By Kenneth M. Swezey



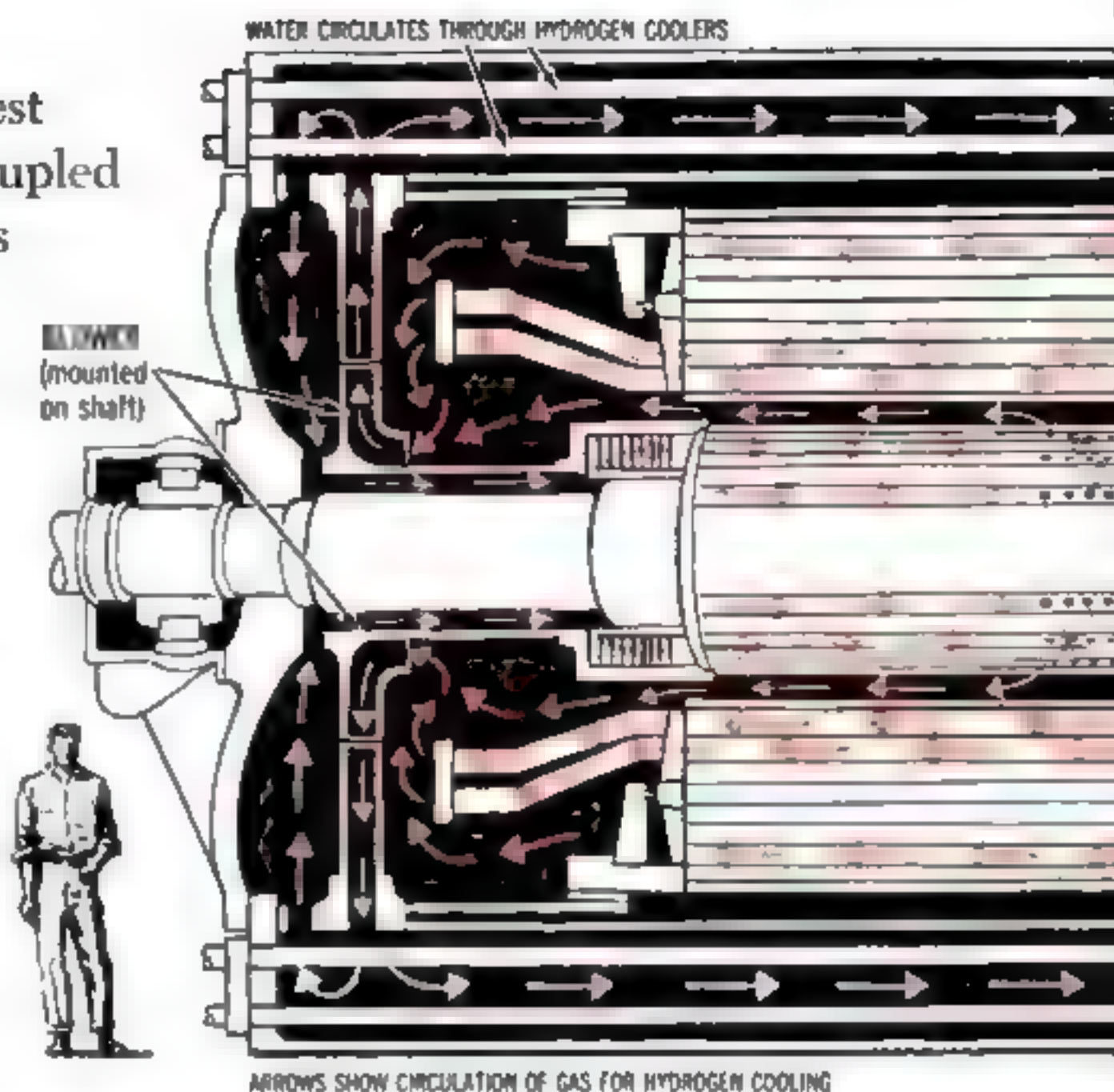
Tornado of steam courses in turn through huge machine's high-pressure turbine, left foreground; intermediate-pressure one, left center; and low pressure ones on other shaft, to spin generators at rear.

CONTINUED

71

Two of world's biggest generators will be coupled to the turbines' shafts

Cutaway view shows design of type of generator that machine will use. To cool it, hydrogen gas at 75 pounds to square inch is blown at high speed through ducts in rotor and stator, as seen in sectional views at far right. Hydrogen serves better than air because it offers only 1/10 the windage resistance to the spinning rotor. It was this system, more than any other single factor, that started the trend to giant turbine-generators. In the new machine for New York City, two record-size generators will have a combined output of more than 1,000,000 kilowatts.



Mfg. Co. in Milwaukee, this turboelectric goliath will be the product of 3,500,000 man-hours of labor.

Whirling under full steam, its turbines will develop a staggering 1,400,000 horsepower—equal to the power of 10,000 autos, or 700 locomotives, and seven times enough to drive the carrier *Enterprise*, largest and fastest ship afloat.

The whopping 1,000,000-plus kilowatts of its generators, enough to furnish light and power for the homes of 3,000,000 New Yorkers, is twice the output of the largest generating unit running today—and more than five times that of the biggest as recently as 1946. A mere pair of machines like it could produce more power than all the water-driven generators at Grand Coulee Dam, or in the new Robert Moses plant at Niagara Falls.

Many advantages. Biggest of a whole new breed of giant generating plants being built by Allis-Chalmers, Westinghouse, and General Electric, it will cut the cost of electricity in four ways:

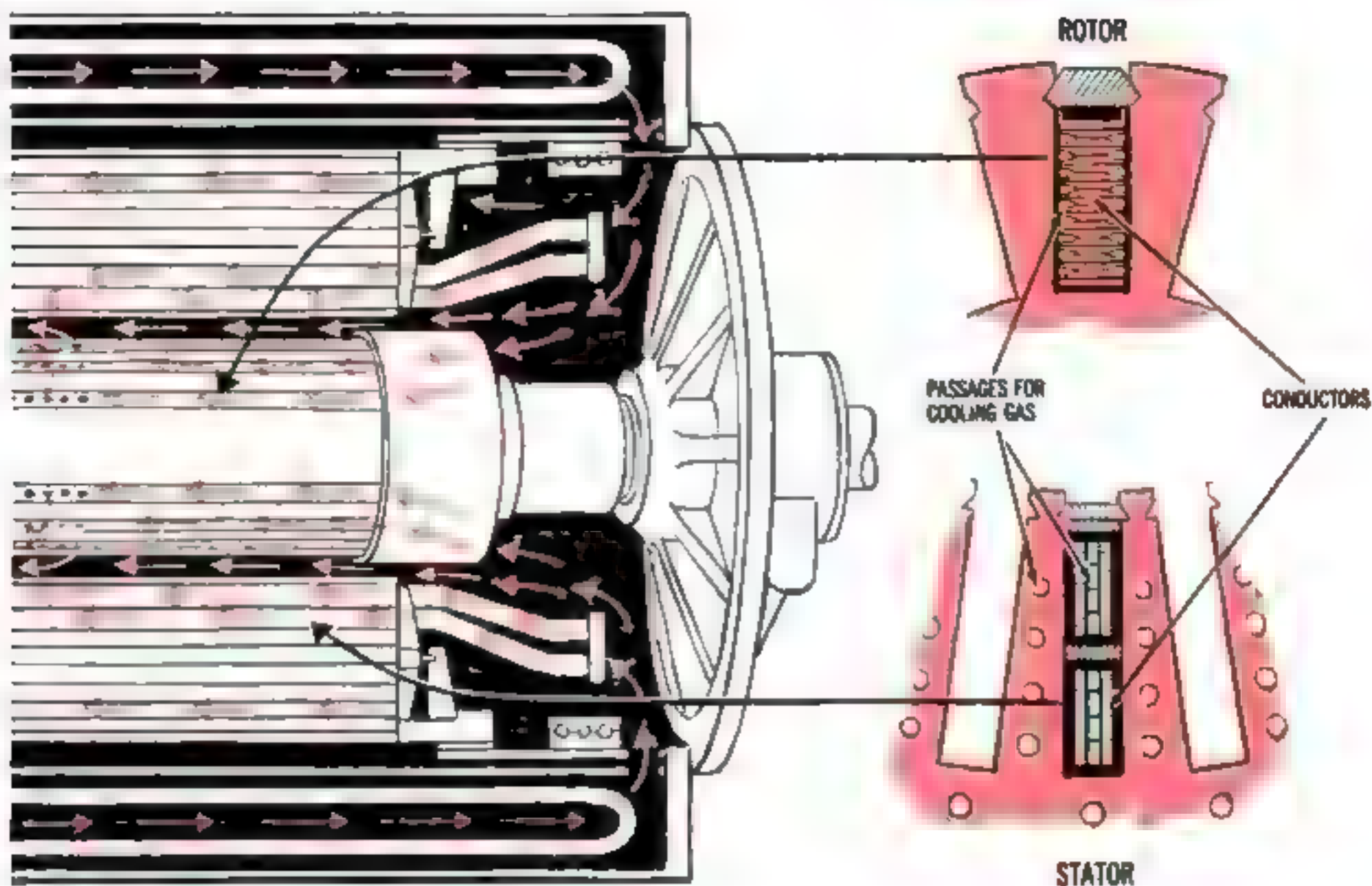
- It will be less expensive to build

than a number of smaller units of the same total capacity.

- It can be operated and maintained by a smaller crew.
- It will reduce fuel cost, because the larger steam flows permit using longer blades that are more efficient.
- Because of improved materials and design, it will take only a fraction of the space machinery of the same output would formerly have required.

Although many details of design have still to be decided, the artist's conceptions on these pages, drawn especially for *POPULAR SCIENCE* by Ray Pioch, will give an idea of the huge machine's general appearance and principles.

Known as a "close-coupled, cross-compound steam turbine-generator," the giant runs on a tornado of steam twice as great as in any turbine now operating. First the steam passes through high-pressure and intermediate-pressure turbines, mounted on a common shaft that spins at 3,600 r.p.m. For compactness, and a slower speed for the big exhaust



blades, the steam then crosses over to low-pressure turbines on a parallel shaft, which spins at 1,800 r.p.m. Coupled to the shafts, two hydrogen-cooled generators—the world's biggest—each produce alternating current at 60 cycles.

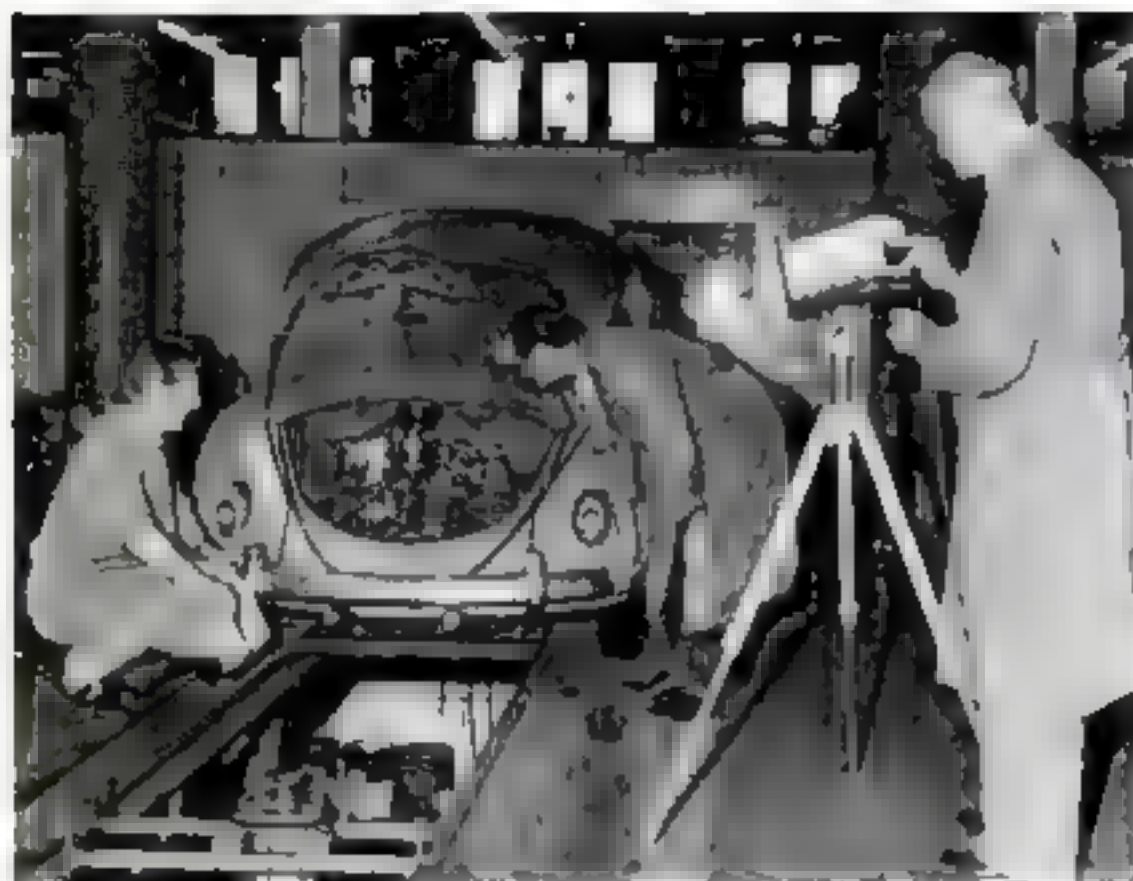
Leaving the throttle at 2,400-pound pressure and 1,000 degrees—enough to make the blades glow red—50 tons of steam a minute will scream through the blades of the high-pressure turbine. Racing through the whole machine in hundredths of a second, it emerges luke warm, and at the below-atmospheric pressure of an almost-perfect vacuum. Measured by volume, the steam will enter at 32,000 cubic feet a minute and come out expanded to about 40,000,000.

"Compounding" the turbine—dividing it into separate units, with blades and casings of appropriate strength and temperature resistance—solves problems of temperature and pressure differences. Handling the immense steam flow of the high- and intermediate-pressure turbines is facilitated by their double-flow, spool-

shaped design. Steam enters each turbine at the center and leaves from both ends. The prodigious volume of exhaust steam calls for *three* double-flow, low-pressure turbines, each with wheels of up to 13½-foot diameter. The tips of the last-row blades will travel faster than sound. The exhaust turbines will be connected in parallel, resulting in sextuple flow.

Hotter-than-1,000-degree steam would gain efficiency, but require more-expensive metals. The new machine gets the same result by diverting the high-pressure turbine's exhaust steam, reheating it to 1,000 degrees, and returning it.

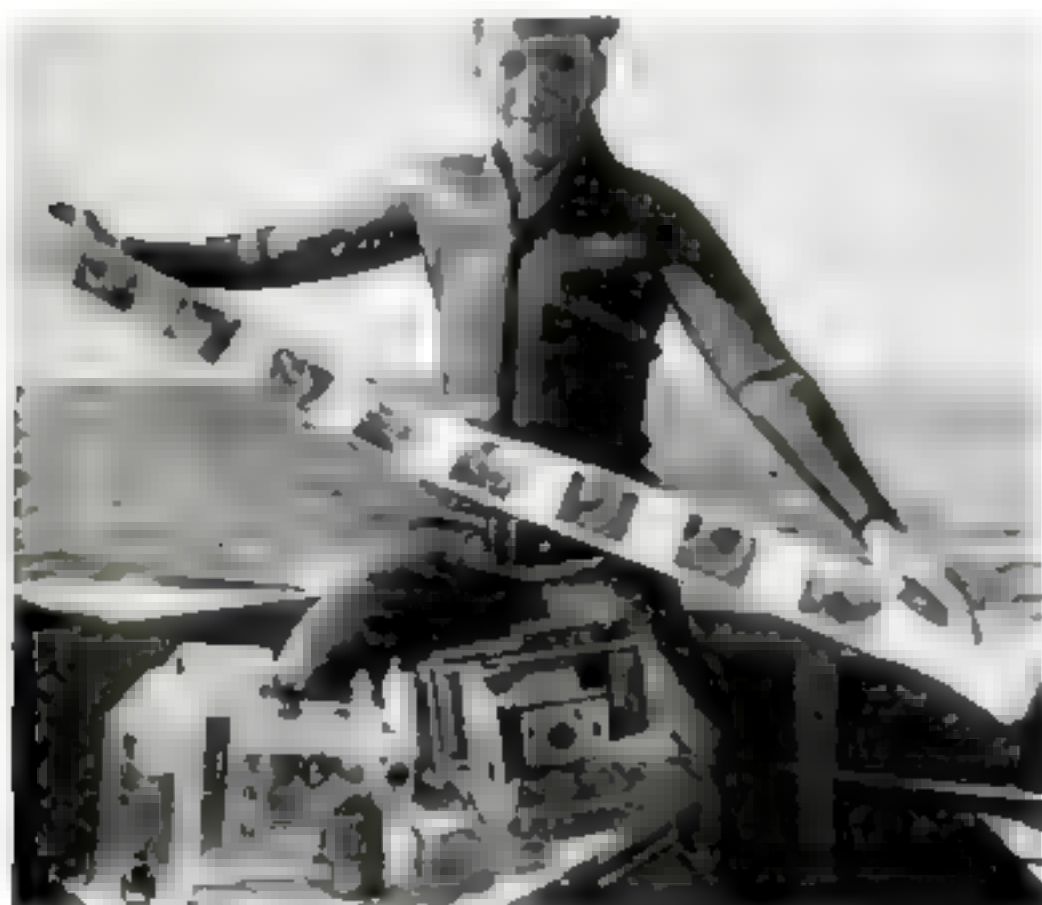
Steam for the monster, required at the rate of more than 6,000,000 pounds an hour, will come from a steam-generating system a city block long and 18 stories high, heated by flames from 350 tons of coal an hour. When the steam has done its work, it will be turned back into water in a giant condenser, cooled by East River water rushing past its tubes at 500,000 gallons a minute. ■ ■



Customers watch on TV screen as their cars are repaired

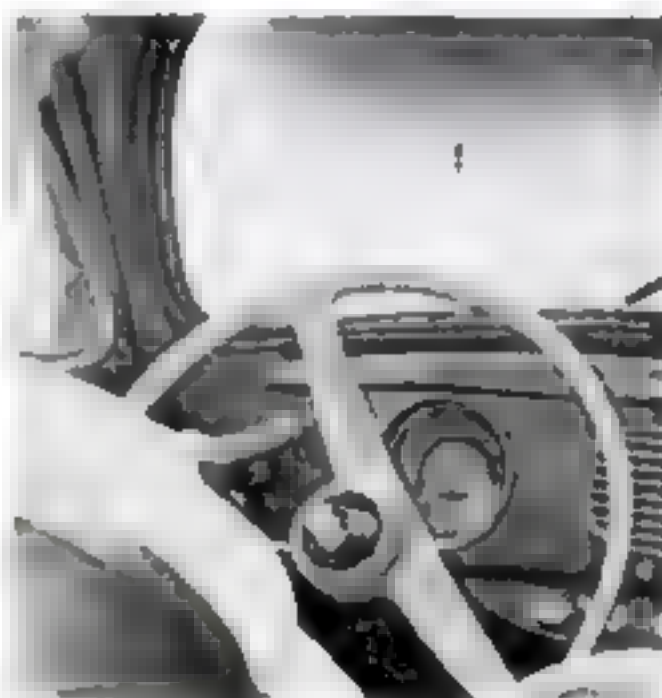
At a big automobile-repair shop in Frankfurt, West German motorists can watch the work being done on their cars without getting in the way of the mechanics. It's done

by closed-circuit television. The camera is focused on the job, and the picture it takes is transmitted to a monitor screen in a refreshment and waiting room.



Polaroid takes pictures under water

With a new pressure-proof, transparent housing for a Polaroid 850 camera, a SCUBA diver can take, develop, and see his photographs while submerged. The prints remain in a continuous strip, wound on an auxiliary spindle in the housing after 10-second developing. Each can be viewed through the back and retaken if necessary. There are six built-in exterior controls, waterproofed by neoprene ring seals. The housing for the camera is made by the Raymond Development Co., Watertown, Mass.



Anti-glare windshield

A new German windshield can be darkened to combat bright sun or glaring headlights, made clear again on dull days.

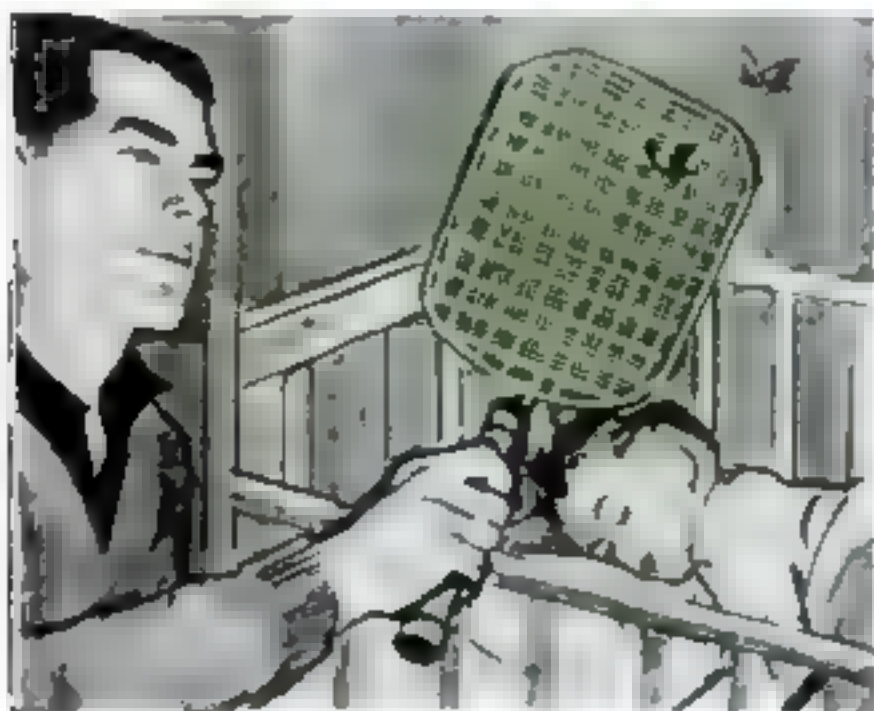
It consists of two sheets of glass clamped together at the bottom and joined flexibly at top. A screw-type plunger pump on the dash injects colored fluid between the upper edges to tint the windshield as far down as needed. When the pump is released, atmospheric pressure squeezes the panes together again and forces the fluid back into the reservoir.



Tow signal aids skier. This recently patented tow rope might make water skiing safer. Electric wires running through the rope would connect a button in the handle to

a signal in the boat. The skier could then call for attention when necessary, and the boat operator could normally keep his eye on the water and traffic ahead.

Swatter electrocutes bugs. You could kill an insect in mid-air with this electric swatter when its body bridged a coarse outer screen and a fine-mesh inner one. Batteries in the handle would provide a low voltage; it would be stepped up to a lethal charge by a vibrator and induction coil.



Shoeshine mask protects socks. A clean shine right up to the tops of your shoes might be possible if you had a plastic guard like this to keep polish smears off your socks. Two ankle-fitting sidepieces would slip into the tops of your shoes and clip together in the front.



More inventors' ideas



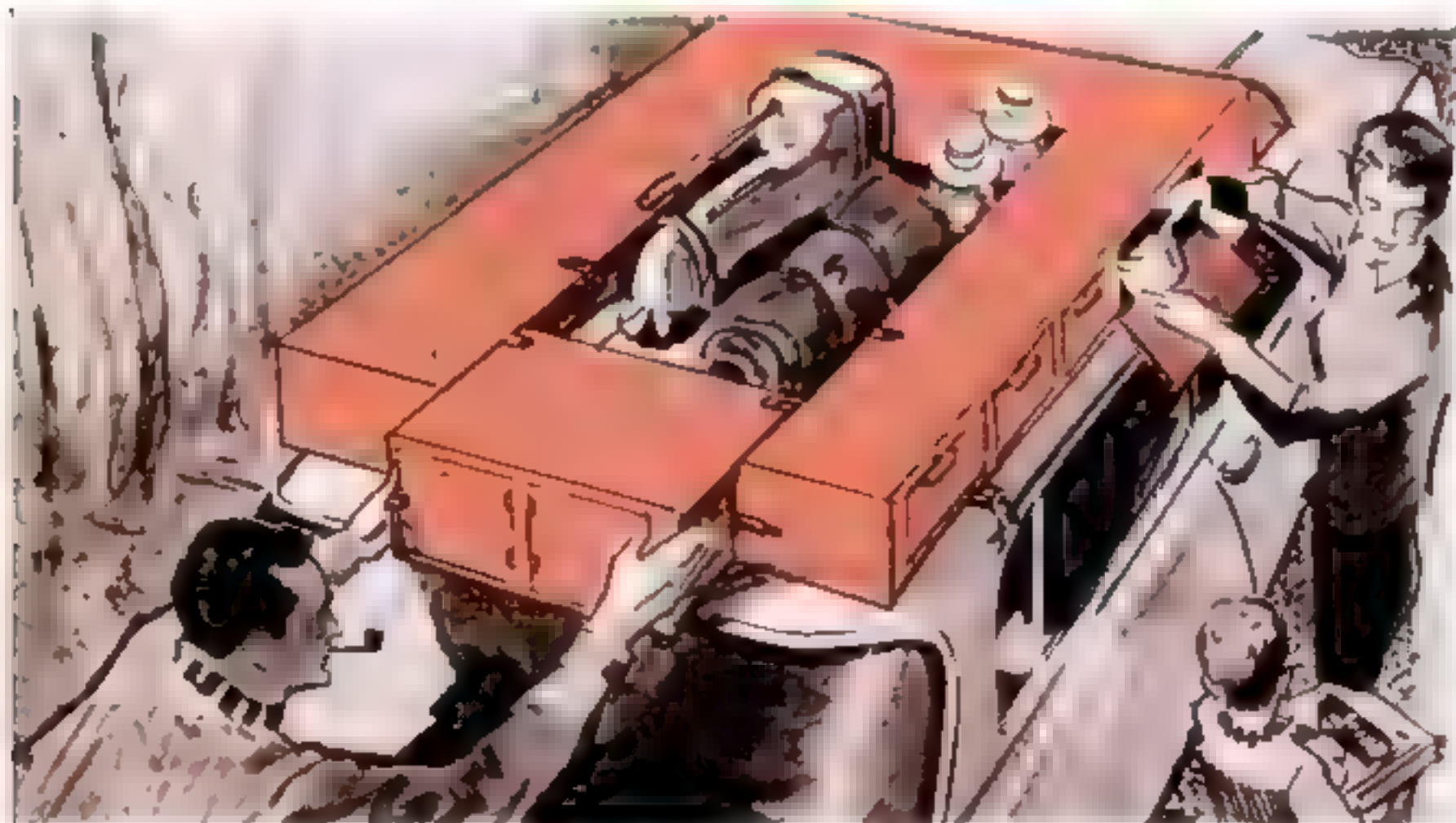
Spring maintains saw pressure. A spring-loaded bar would hold the cutting edge of this saw pressed firmly against the limb of a tree so you could cut it off from the ground instead of from a precarious perch on a branch or a ladder. Threaded handle sections would let you extend the reach of the saw by several feet.

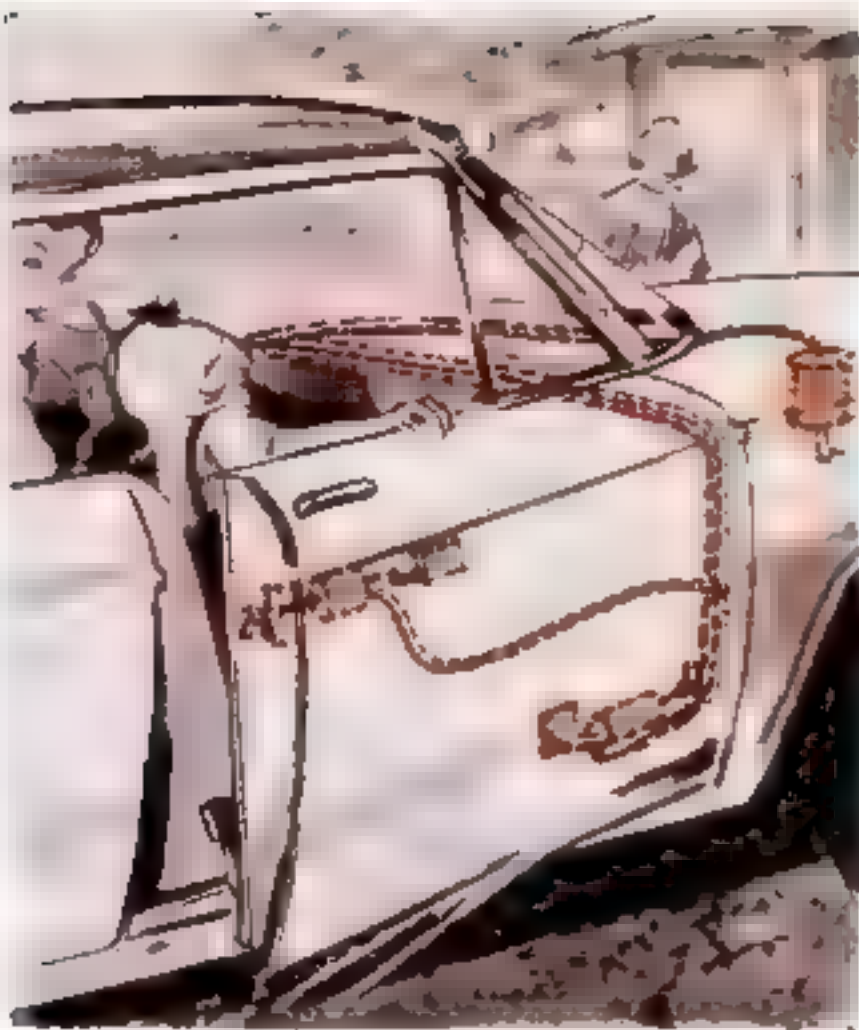


Extension pedal steers outboard. This tiller control would let you troll from a more comfortable forward position, and leave both hands free for fishing. Its flexible cable would link the outboard's steering arm to a pivoted treadle. Pressing either side of the treadle would move the steering arm in a corresponding direction.

Car-top drawers store your gear. The detachable cabinet sections of this carry-rack might let you tote more camping equipment in better order. The carrier's base

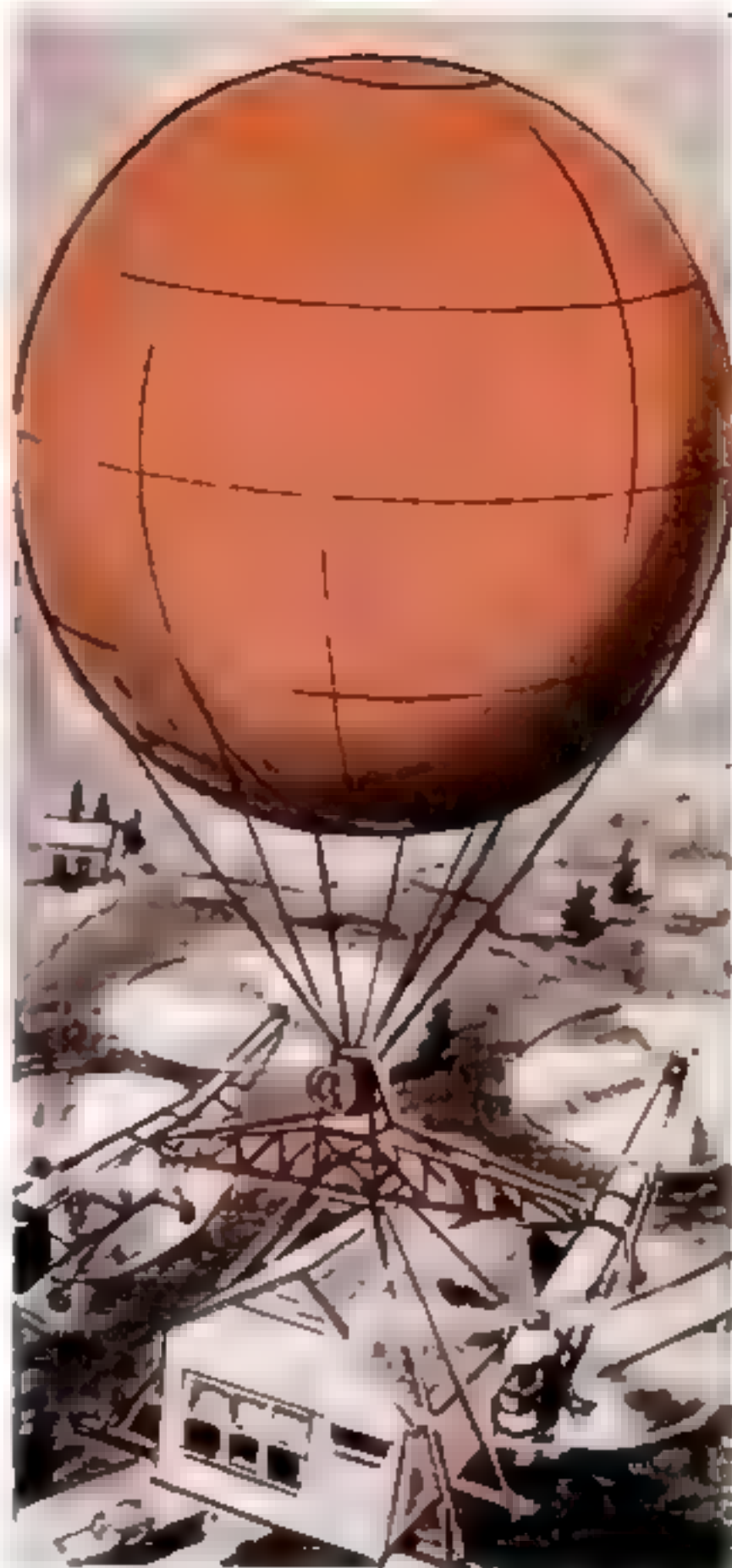
platform would clamp to the roof in the usual way. Simple latches would secure the easy-to-pack drawer sections around the platform, leaving an open center well.





Piston latches car door. Push a button, with this motorized door operator, and compressed air would close a car door slowly and then give it a final slam to secure the latch. In normal use the mechanism would keep any of the doors from opening while the car was in gear. All doors could also be operated manually.

Iron feeds solder through tip. The upper part of this hollow-cored iron would hold strip solder and feed it—at a push—into a small well in the tip. The heated tip would melt the solder but hold it by capillary action. To force it out, you'd feed a blob from the magazine. A flexible gate would shield the magazine from the hot tip.



Balloon adds to copters' lift. The pay load of coupled helicopters could be greatly increased, says this inventor, by adding a balloon to the freight-carrying combination. By taking over part of the lift, the big gas bag would make the force of the rotors available for propulsion and control.

The following patents have been issued on these inventions. Tow signal—No. 2,994,861 to M Reinhardt, Jr., Lubbock, and J McElmurray, Nolan, Tex.; Swatter—No. 2,881,554 to T Laine, Culma, Calif.; Sack Guard—No. 3,008,146 to N Francone, Chicago, Ill.; Saw—No. 2,984,004 to A Dalby-Ralls, Newport Pagnell, England; Steering pedal—No. 3,002,398 to R Beamer, W Seattle, Wash.; Car rack—No. 3,008,784 to A Atlard, Wilmington, Mass.; Door closer—No. 3,002,581 to R Dreibel et al, Cheektowaga, N.Y.; Soldering iron—No. 3,003,049 to J Thomas, Baltimore; Balloon lift—No. 3,008,665 to F Piaszek, Haverford, Pa.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.



Winged racing car hits 226 m.p.h. in setting new speed record

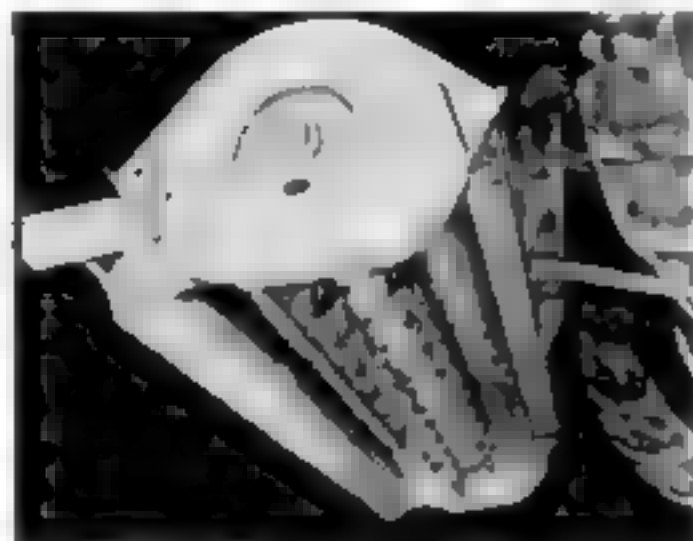
With downward-curved wings to keep it from becoming airborne, this car broke the world's closed-track speed record. Art Malone drove it around Daytona International Speedway at 181.561 m.p.h., with occasional bursts up to 226 m.p.h.—at half

throttle. He won for owner Bob Osiecki \$10,000 posted for the first vehicle to lap the track at over 180 m.p.h. The car's supercharged Dodge V-8 develops 840 hp. Osiecki hopes further streamlining and a new engine will add 20 m.p.h. more.



New mower cuts by flailing

A tractor-towed flail mower has been developed by Ford for cutting grass in parks, and on golf courses and estates. Its blades hang free from a spinning rotor, pulverizing grass cuttings and weeds in-



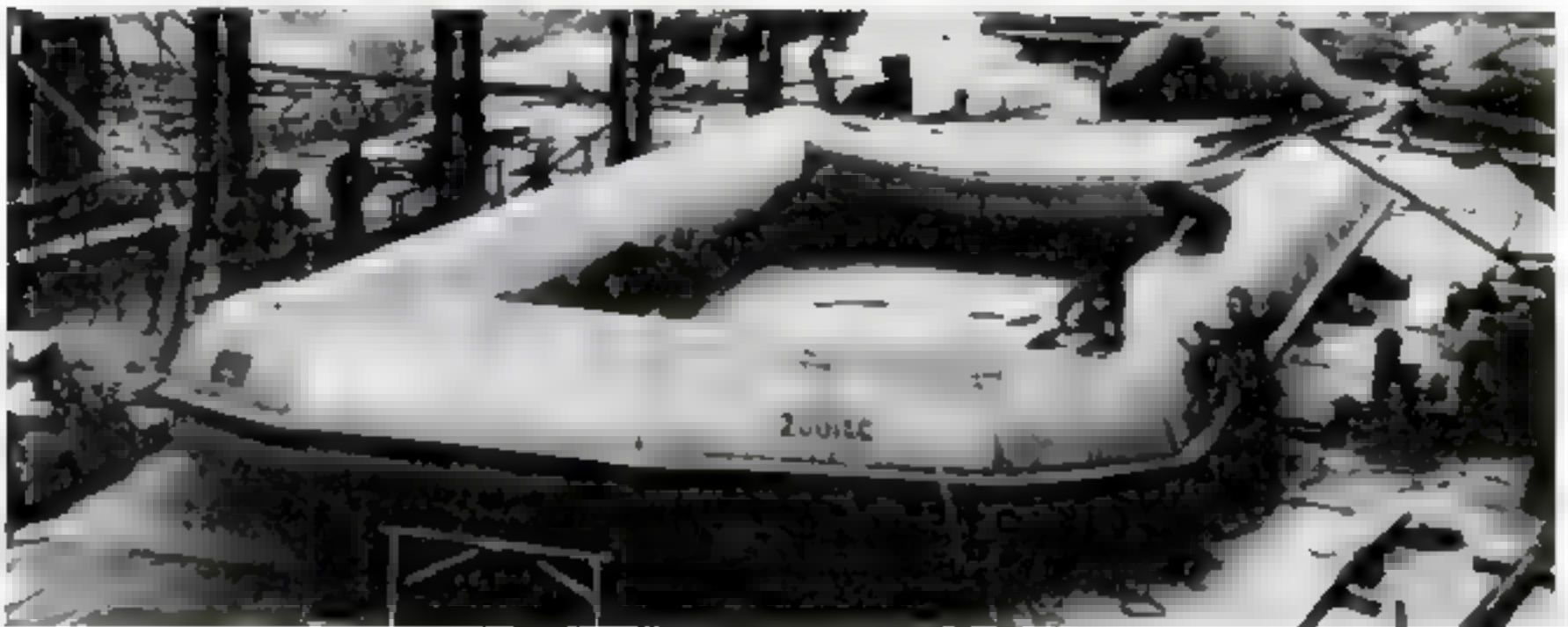
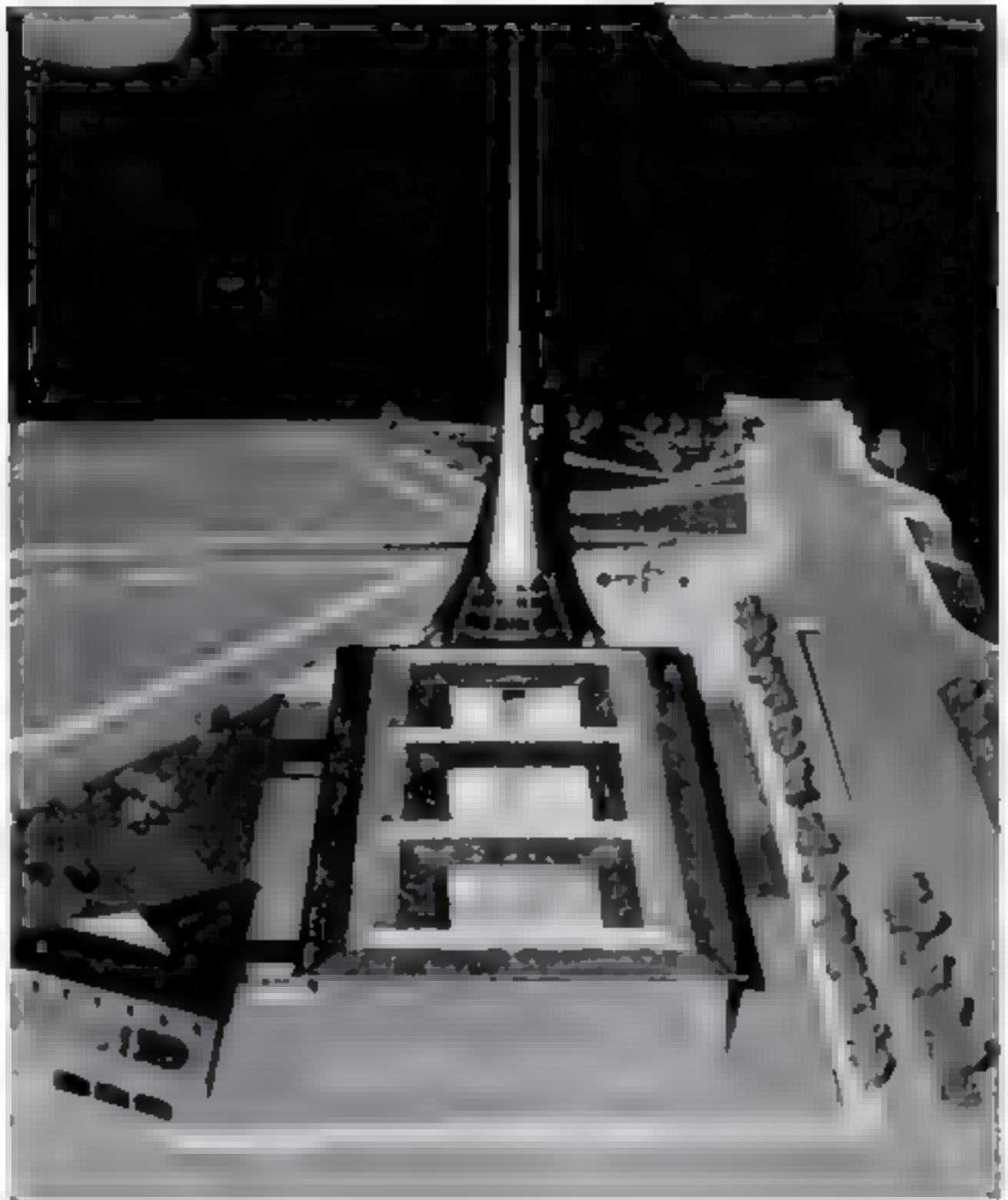
Loose-hanging flails on the whirling rotor cut in downward arc, pulverizing clippings and leaving no windrows or debris in the mower's path.

stead of cutting with a scissors action like a sickle-bar mower, against a stationary bar like a reel, or with horizontal shearing like a rotary mower. A roller sets height of cut from a fraction of an inch to four inches. The mower is manufactured in three widths: five, six, and seven feet.

Art center for Down Under

A 415-foot spire, sheathed with copper and tipped with gold, will dominate a new \$10,000,000 cultural center in Melbourne, Australia.

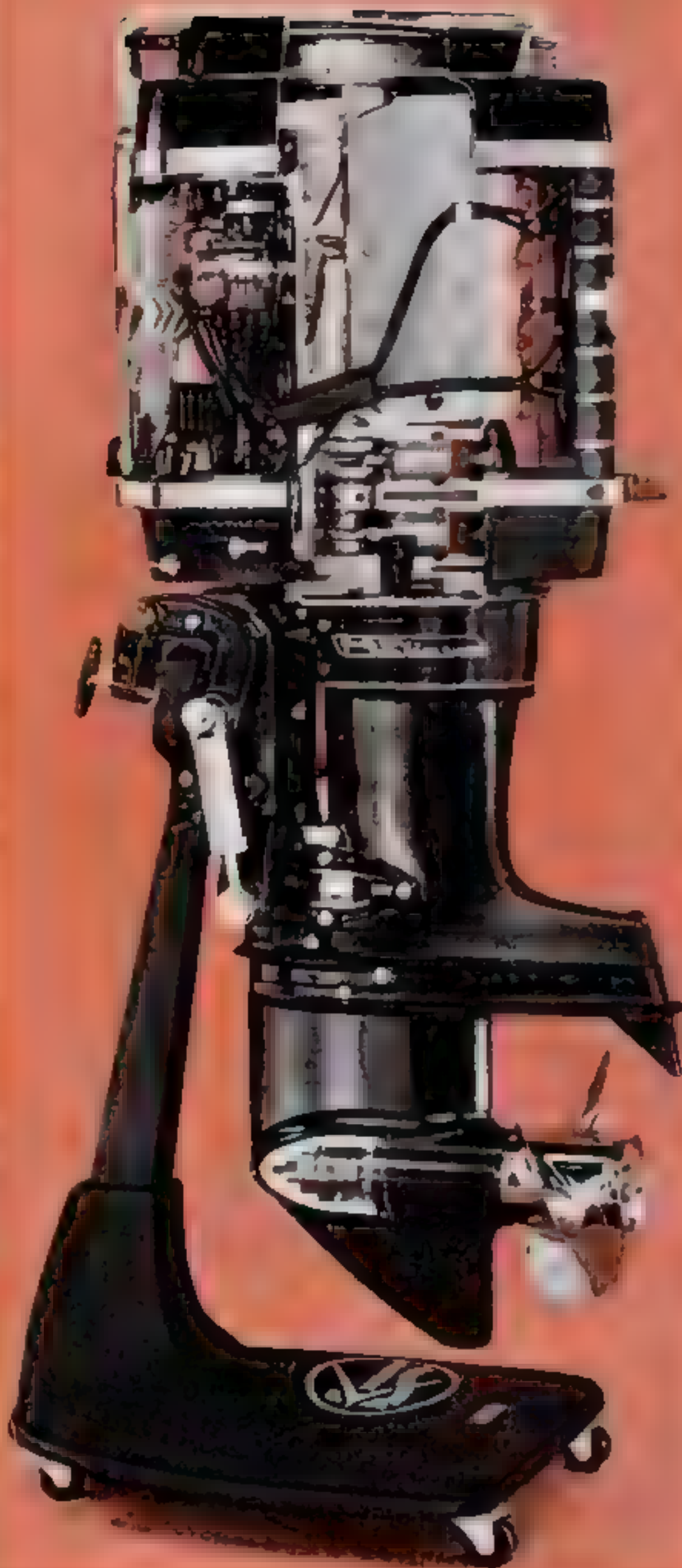
Four floors in its base will house three theaters (one with a stage tower rising 90 feet through the center), a restaurant for 200, a cafeteria, lookout balconies, and assembly rooms. The 500-foot-long building in the foreground of the model at right will contain the National Art Gallery. Two of its three open courtyards will be covered by sliding roofs.



Blow-up raft makes 30 knots

Filled with air, the boat above is 65 feet long and 30 feet wide; deflated, it packs into a container the size of a clothes closet. Although the Amphitrite weighs nearly six tons, the components for its as-

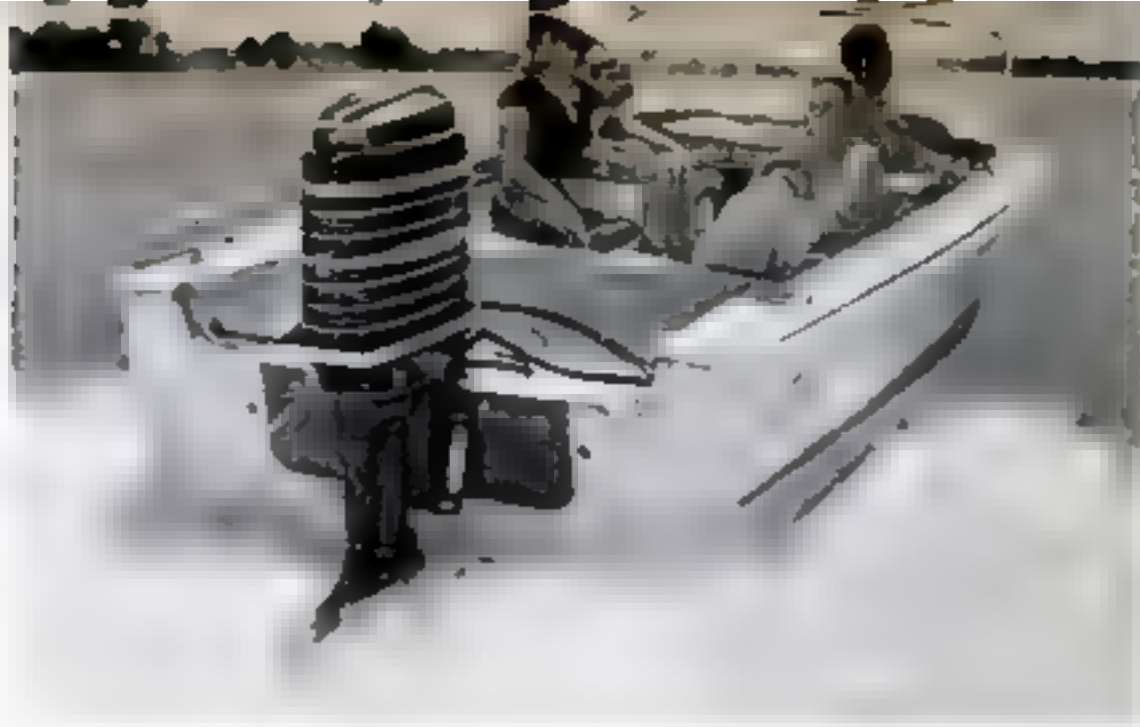
sembly can be lifted by one man and its nine nylon-and-neoprene inner tubes inflated in an hour. Two 300-hp. diesels will give it a top speed of 30 knots. The inflatable boat was built by Zodiac, of France, for airborne oceanographic expeditions by Capt. Jacques Cousteau.



Mercury's big kicker.....

It's the first outboard to break the 100-hp. barrier—and it does it with only 90 cubic inches. What's more, the 1000 is as light and compact as many engines that develop less power

Off for a day on the water, with power courtesy of a Merc 1000. These healthy sixes can be recognized by the thin chromed stripes around their housings. Motor is a completely new design, engineered for 1,200 pounds of static thrust



How They Harnessed a Hundred Horses

By E. F. Lindsley

LINE up six modest cylinders on a drop-forged crankshaft, train them to breathe like an Olympic track team, throw in a dozen other engineering tricks, and maybe you too can come up with a 100-hp. outboard.

Engineers at Kiekhafer, Fond du Lac, Wis., did just that in the Mercury 1000—though, as with the four-minute mile, a lot of bystanders said it couldn't be done.

There were problems, as I discovered when I visited the engineers who built it. How do you get this much gusto into a package so light that two office-soft guys can lift it onto a transom? Or this much geared-down torque—she puts out more than 1,200 pounds of static thrust—through a slimmed-down housing that keeps water drag low?

You don't do it with warmed-over parts from smaller engines. Besides the forged crankshaft, there are drop-forged alloy-steel rods, forged-aluminum clamp brackets, forged-steel suspension yokes, and—no kidding—forged pistons. The keep-it-together department also got its share of attention. I noted self-locking nuts, aircraft-steel support studs, and

side rails husky enough to support a lift sling.

It's balanced, too. I tried a one-hand snatch on it—with doubts—and had to admit it was as poised as a sparrow on a telephone wire: The center of gravity is about an inch above the transom level.

My eye caught something else on that first heave-ho: a recoil-starter handle. I chuckled. After years of seeing smaller-powered motors coyly hide their notched-and-grooved pulleys behind a maidenly shroud, it was refreshing to see that Merc engineers agree a good recoil starter can help in a tight spot. (And because the cylinders are of relatively small bore—2½ inches—you *can* pull the engine through without sweat. I tried it.)

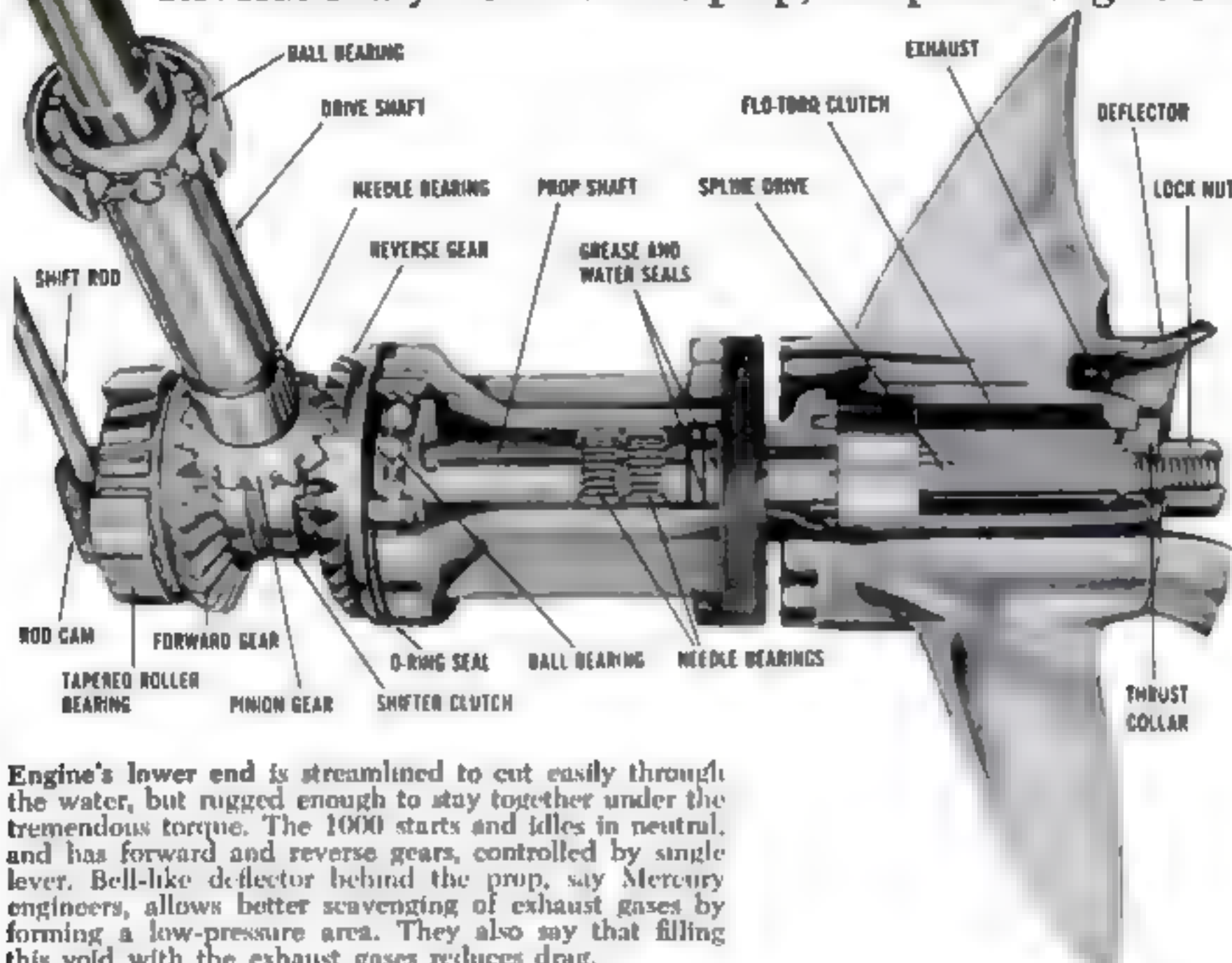
Double-coil ignition. The presence of the starter doesn't mean that the 100 horses are hard up for a good electrical starting system. I saw tightly secured terminals, good splash and condensation protection, and even a fail-safe ignition system. Two sealed coils fire three barrels apiece in one-five-three and four-two-six sequences. Scratch one trio and you can still limp home on the other without punishing the engine.

Dual coils also mean increased cam

CONTINUED

11

Revolutionary from head to prop, this potent engine offers



Engine's lower end is streamlined to cut easily through the water, but rugged enough to stay together under the tremendous torque. The 1000 starts and idles in neutral, and has forward and reverse gears, controlled by single lever. Bell-like deflector behind the prop, say Mercury engineers, allows better scavenging of exhaust gases by forming a low-pressure area. They also say that filling this void with the exhaust gases reduces drag.

dwell and better saturation—something to think about when 4,000 r.p.m. means 24,000 little blue sparks a minute. (The engine output peaks at 5,200 r.p.m.)

But what bothered the tinkerer in me was that the distributor (an auto-type battery ignition) was lock-wired and sealed. They just may have a point. On a high-output engine, dockside screw-driving might not be a good idea.

I was stumped by two strange pigtails trailing out from the distributor. It turned out that there's a good reason for them. They're flexible tubes that vent the distributor externally and avoid introducing explosive gas fumes into the spark factory.

More horses than inches. Timing's tricky when you're shooting for more than one horsepower per cubic inch. The Merc 1000 uses a positive notched-type drive belt to keep the distributor in step. A smooth-working cam guides the relationship between throttle opening

and spark advance. You get economy at low power by plenty of spark advance and a restricted throttle opening. At full throttle, the carburetor opens automatically to feed the horses.

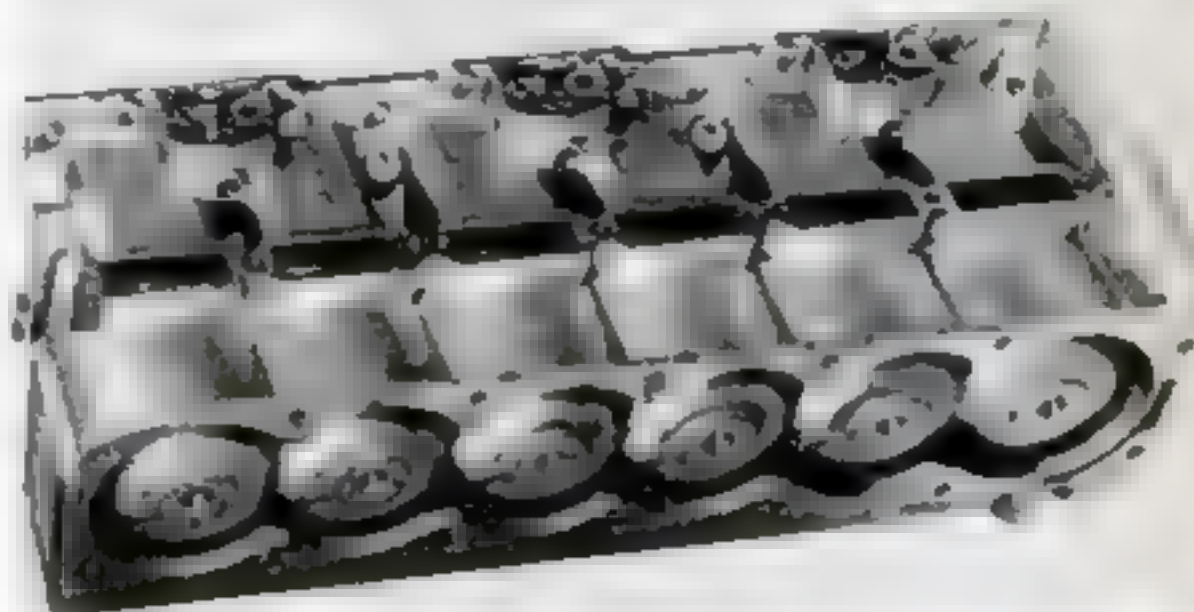
It was "hands off" on the carburetor adjustments, too, I discovered. This was a blow since one of my favorite ways of cooling off on a hot day has always been to ride side-saddle on the transom while twirling happily on the main-jet needle valve. Mercury engineers suggested that not all their customers share my joys.

I gathered that they felt that fiddling with three carburetors might not be the most constructive approach to amateur tuning. Each carburetor feeds a pair of cylinders through fixed main jets. If you plan to boat at high altitude, your dealer will change the jets for you. As a sop to the itchy-fingered, they *do* allow you to adjust the idle mix.

The cylinder pairs that the carbs feed are alternate-firing twins, vertically

a record high in horsepower in a deceptively compact package

One-piece, die-cast aluminum block, only one made in six-cylinder outboard form, is heart of Merc line, including the 1000. Though aluminum is new in automobile industry, Mercury has used it since 1947. A water passage between each pair of cylinders allows fast warmup of the induction system by forming a heat path from cylinders to reed-valve body.



stacked and independent except for a common crankshaft. Phase relation of crankpins results in six power strokes per revolution at 60-degree intervals. Here's where the engineering oomph comes in. It's the special care and feeding of these three sets of twins that lead to the 100-hp. payoff.

It's all done with valves. Internal reed-valve bodies are mounted on the crankshaft. They also serve as intermediate main bearings, and wall off the crank chambers of adjacent cylinders. These three valve bodies plus two more intermediate main bearings and two end main bearings add up to the seven that all six-cylinder engines should have for

maximum stiffening of the crankshaft. (Most auto sixes have fewer.)

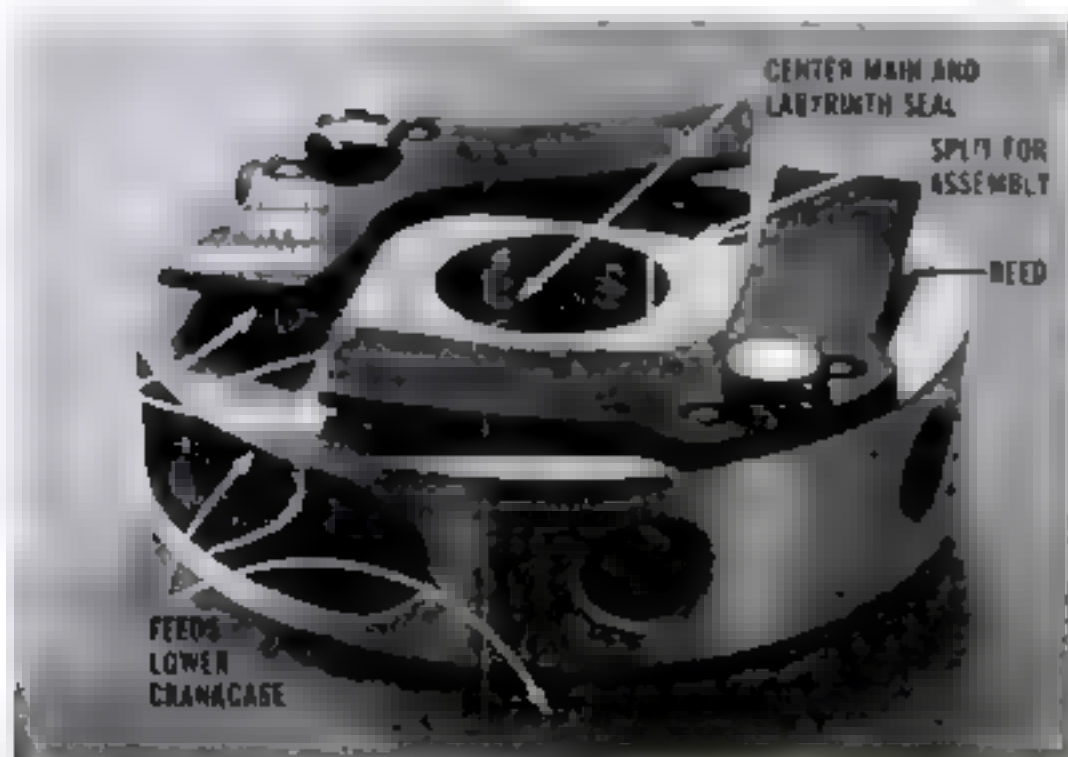
The three carburetors in turn are mounted on the crankcase and feed directly into the valve bodies. (More conventional practice plants a reed plate and sometimes a manifold between the carburetor and the crankcase compression area.)

In operation, of course, one reed valve opens as the piston on its side moves up and leaves a low-pressure area behind it. At the same time its opposite number clamps shut as its piston moves down on the power stroke.

Curiously enough, the valves at rest do not plaster themselves flat against the valve body. The tips curl about .001 inches—enough to be visible against the light. Sturdy, curved back-up plates prevent them from springing back too wildly in action.

No stat; no choke. In contrast to other big outboards, the Merc lacks both a thermostat and an automatic choke. It doesn't need them—again mainly by virtue of the three valve bodies. Mounted in tight around the shaft and massively made, they pick up engine heat quickly—enough to warm the incoming mix significantly and eliminate the extra controls.

The design of the precision-cast single-unit block helps, too. Although it's not apparent from the outside, a deep water passage plunges down between each



Reed material is .010-inch-thick Swedish blue steel. Reed-valve body serves as a dividing member between adjacent crank chambers. It also functions as an intermediate main bearing.

pair of cylinders to the reed-valve-body zones. This way, still more heat gets carried where it's needed to speed warm-up and minimize puddling. (Puddling is outboard-engineers' lingo for fallout of unburned fuel and oil on intake passages.)

Long famous for fast, hot engines that wind up to high speeds and pull power from a pack of small cylinders, Mercury has spit-and-polished its pistons to suit. Pick one up and its lightness astonishes you. These are not heavy castings but highly refined thin-wall structures created by cold extrusion—a form of forging. The shape's something special, too.

In two-cycle engines, the inlet and exhaust ports, and the piston crown shape, are the vital variables in performance. The compressed charge from the crankcase rushes through the inlet ports as the piston skims downward. The new charge blasts across the top of the piston and chases burned gases from the previous stroke out the exhaust ports. Let the incoming charge take too direct a path and a lot of good fuel goes out the flue, too. Let it dally and a residue of burned gas hangs around.

The piston crown contour can help control this action. But it can also control the compression of the new charge—shaping it for smooth, uniform combustion. Mercury engineers have come up with a shape that does both: a head that permits wedge-shaped "squish" chambers like the kind four-stroke engines use.

The lower end. The slide-rule crowd is also proud of the driving end of this big job. Blessed with a full gearshift, the 1000 starts and idles in neutral. As might be expected from the power they carry, gears, bearings, and shafts are as sturdy as the housing around them. Bolted-on lower sections are grimly frowned upon.

A water intake trailing like a ventral fin from the cavitation plate may be adjusted for a trim-tab effect when desired. Directly below is the slightly flared, hollow propeller hub that also serves as exhaust extractor on the 1000.

All props and centrifugal pumps have a low-pressure area at the hub. The Mercury takes advantage of it to coax the flow of the exhaust for better breathing. The design guys also claim that filling the vacuum behind the propeller hub with gases helps reduce drag.

There are a dozen different prop sizes to choose from, all for clockwise rotation (no left-hand engines are being built). They range from a 25-inch pitch down to an 8½-inch pitch recommended for gross loads of 12,000 pounds or so.

Kick-up protection. Although I'm accustomed to fairly clear lake boating, I still wondered how Mercury would handle the problem of kick-up from underwater obstacles. Remembering stories of grim accidents at night with floating logs, I was fascinated by the heavy hydraulic shock absorbers and the ignition cutout switch. The engine is suspended in such a way that the shock absorbers offer no resistance to an obstacle until the skeg is higher than the bottom of the boat. Then the shock absorbers take control and reduce the rate of tilt-up.

Since it's not the first impact but the rebound that bursts things—when the wildly overspeeding prop drops back into the water—the Merc carries a mercury switch that cuts the ignition on kick-up, and then allows it to pick up again when things have settled down. At Merc's proving ground, test drivers wham into floating telephone poles just for fun.

As for the fuel consumption you can expect with a 100-hp. two-cycle, there's no denying that fuel is burned in proportion to power delivered. Yet the gents in the engineering room at the plant say that the very size of the 1000 often lets it operate in an economy range where it laps up less fuel than smaller engines running full out. Fuel consumption, they argue, should be measured against boat miles covered and work done.

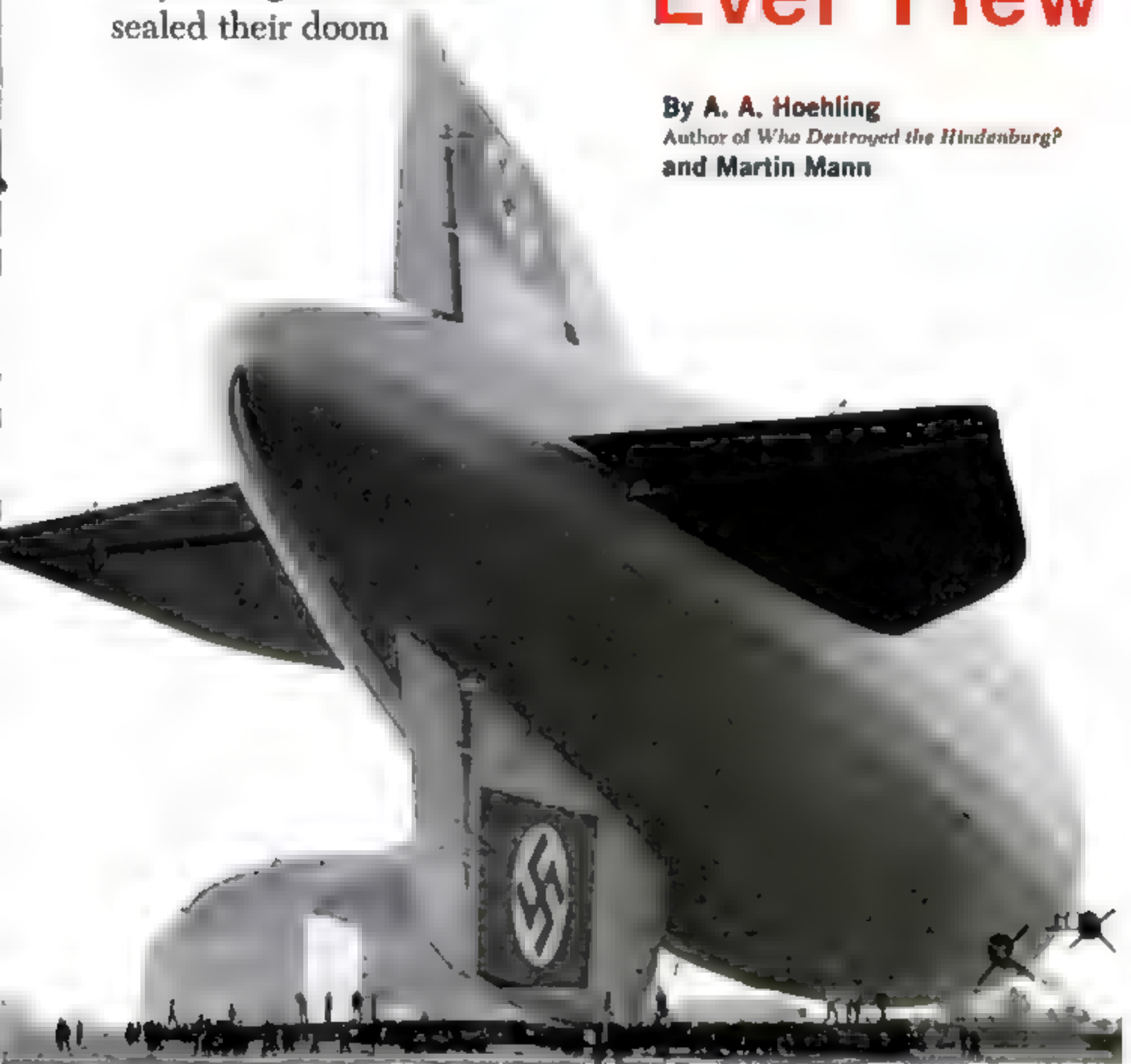
And whether that work is slugging it out driving a barge 12 hours a day or driving a light runabout at breathtaking speeds on the weekend, the Merc 1000 packs all the power you need, beautifully. ■ ■

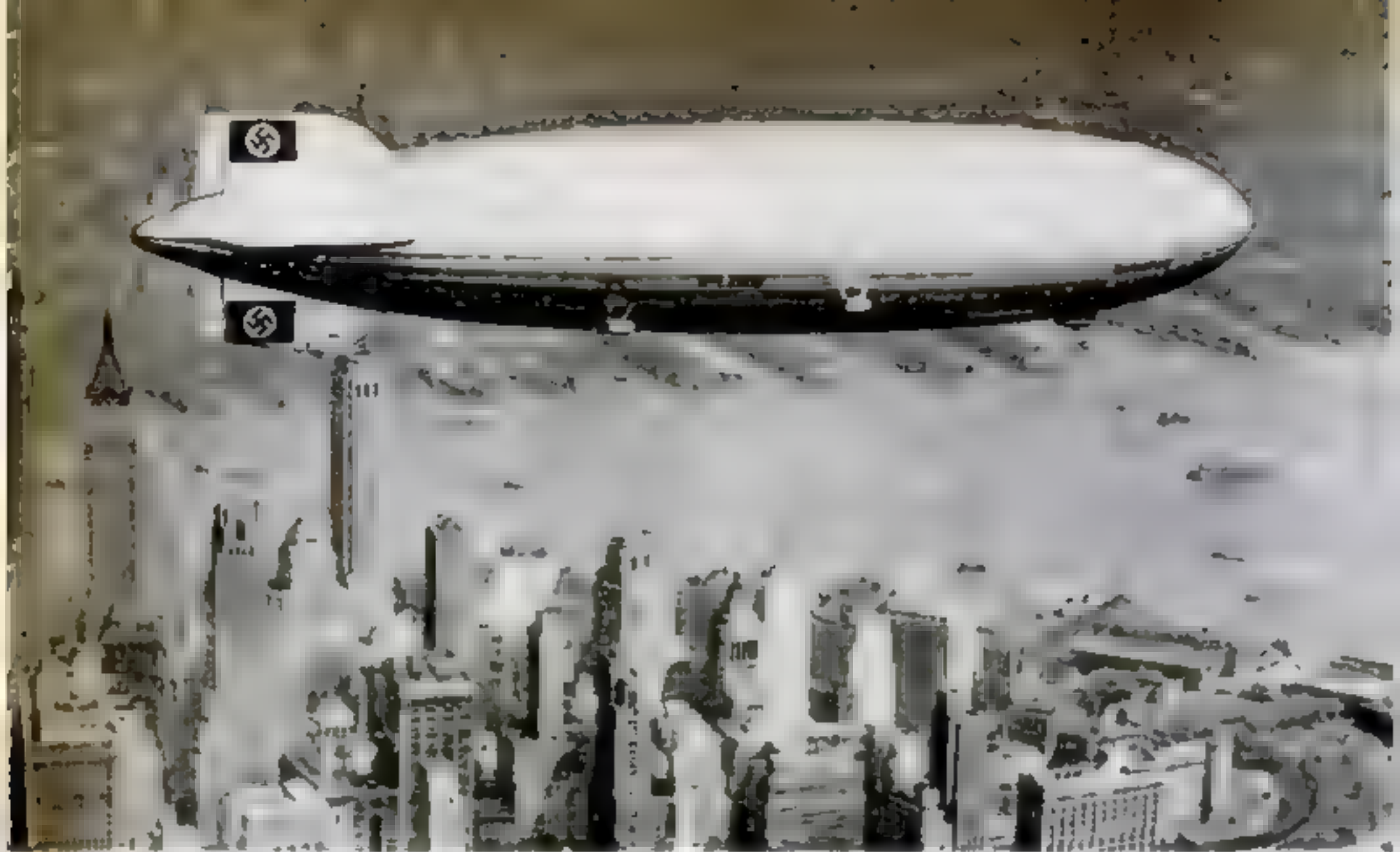
The sky has never seen anything to match the giant Zeppelins. Like luxurious airborne hotels—with promenades, staterooms, dining salons, showers—they swiftly flew passengers over oceans. Yet tragedy flew with them until final disaster, 25 years ago this month, sealed their doom

The Biggest Birds That Ever Flew

By A. A. Hoehling

Author of *Who Destroyed the Hindenburg?*
and *Martin Mann*





Skimming Manhattan skyscrapers in '36, the Hindenburg displayed her astonishing bulk. Enthusiasm for Zeppelins—or, more properly, dirigibles—ran so high that Empire State Building was topped with a mooring mast (where TV antennas are now). No airship ever made an actual landing there—winds are too tricky.

THEY were unbelievably long—as much as a sixth of a mile. Their shadows darkened several city blocks. They held gas enough to heat a small town for months.

In the caverns of their compartments they carried, with space to spare, dozens of passengers and colorful loads of bulky cargo: circus animals, sports cars, even airplanes. Voyagers paced their promenade decks, stretched out in smoking lounges, even sang in shower baths.

The Zeppelins looked like whales and handled like submarines. But the sky was home.

They were the biggest birds that ever flew. There had been nothing remotely like them before they came. There has been nothing remotely like them since the last died in flaming public death. That happened just 25 years ago this month. Yet already one of the boldest achievements of aviation science is nearly forgotten.

ON Thursday, May 6, 1937, the great gray bird droned over the eastern coast of the United States, inbound at the start of her second season of regular transatlantic service. The day was warm and stormy. She was already 10 hours late. And now she had to stooge over the Jersey beaches, waiting the forecasted clearing of the weather.

This was the largest and most extravagant aircraft ever flown. Her builders had labeled her LZ-129—the 129th *Luftschiff* (airship) Zeppelin—and christened her Hindenburg (after the World War I field marshal who was conned by Hitler into surrendering control of Germany).

In the staterooms, impatient passengers tidied up their valises.

At the Lakehurst, N. J., landing field waited a corps of reporters, photographers, even a special radio-broadcasting crew. Supervising ground operations was the U S Navy's foremost lighter-than-air expert, Cmdr Charles E. Rosendahl.

Now, in the twilight shortly after 7 p.m., the Hindenburg ponderously nuzzled up to the mooring mast.

IN 1937, this was *the* way to travel—the quickest, most comfortable transatlantic crossing possible. The fastest ocean liners took nearly twice as long. Commercial airplane flights were still two years in the future.

The Hindenburg had departed Frankfurt on Monday, May 3, to the customary fanfare of glowing press notices. Aboard climbed the passengers, surrendering their matches and cigarette lighters as they entered. Mrs. Marie Kleeman bound for a visit with her daughter in Massachusetts. Joseph Spah, an acrobat returning from European engagements. Poetess Margaret Mather flying home to New Jersey, and 33 others. The crew was headed by the veteran *Luftschifffuhrer* Kapitän Max Pruss.

There was no foreboding of historic tragedy as the command "Up ship!" resounded. This was a gay adventure. If you were a Very Important Passenger, you could count on a tour of the fantastic ship. It was an opportunity not to be missed, for the Hindenburg was a masterpiece of engineering.

The sheer size made your jaw drop. This Zeppelin was enormous: 135 feet across the middle and 804 feet in length. From stern to bow she extended more than three city blocks. If stood on end, she would have reached the 67th floor of the Empire State Building, and towered over the Washington Monument.

The inside of this monstrous football was equally impressive. You walked to the nose along the *Kiellaufgang*—a narrow aluminum catwalk atop the keel girder. There was no railing; except for a few guidelines, only a maze of cross-bracing wires and the thin fabric of the hull separated you from the Atlantic Ocean 600 feet below.

From the nose, you looked back on the elaborate blue-painted skeleton—"It seems like a cathedral," one captain had rhapsodized. The lateral support for the fabric skin was 50 aluminum rings (not truly round, but 36-sided polygons).

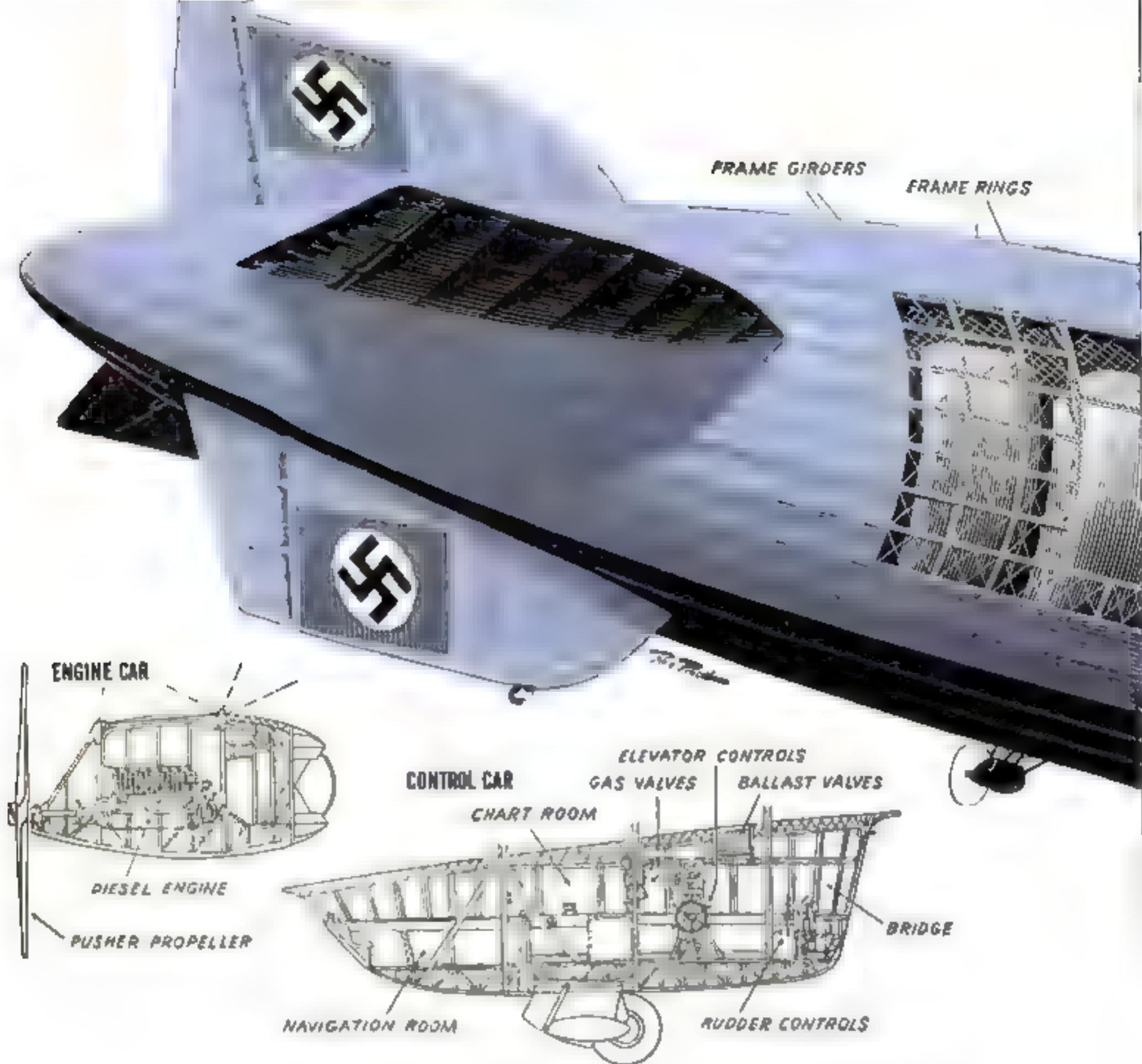
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Count von Zeppelin, big birds' inventor.



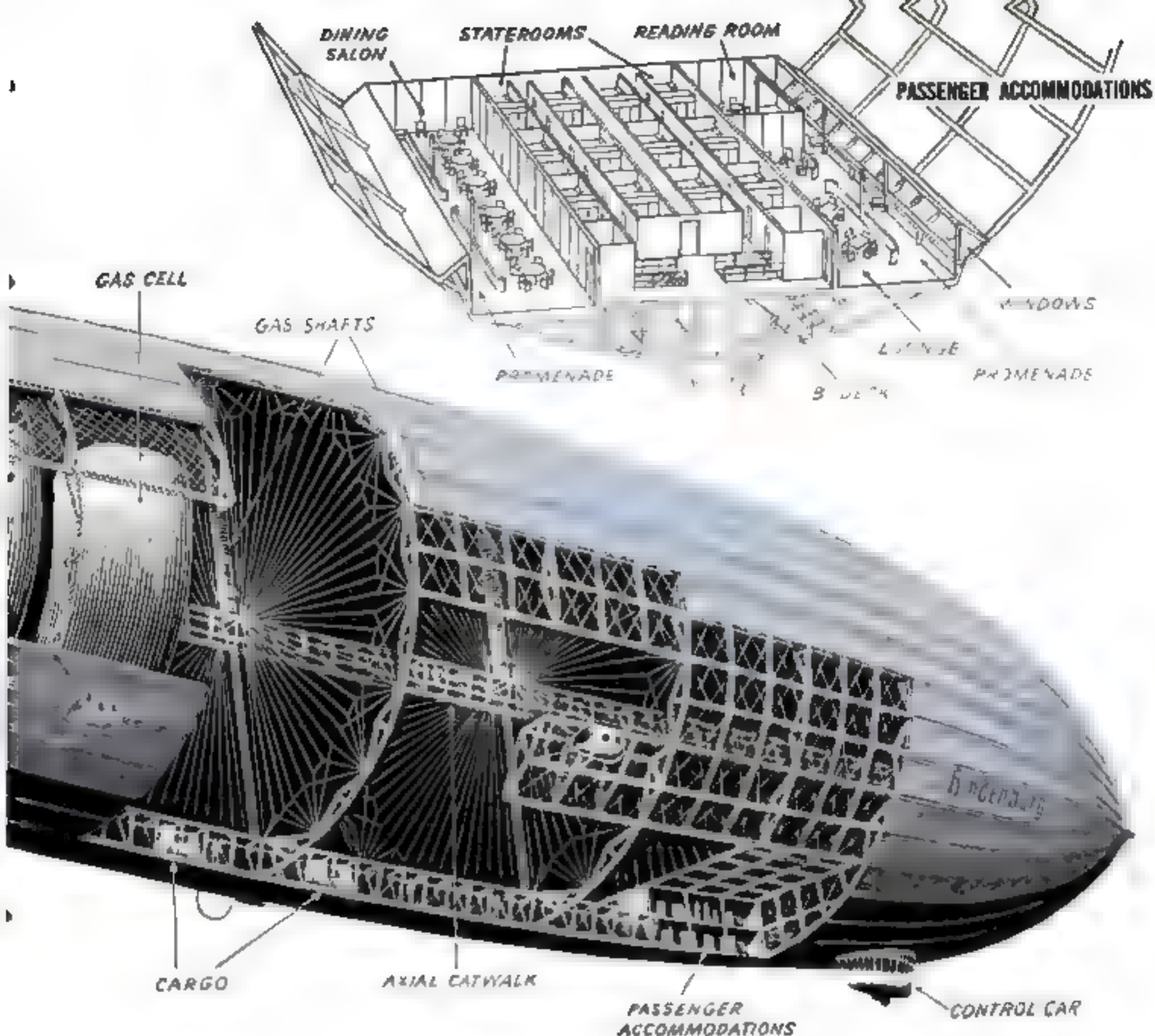
Passenger section was entirely inside the hull, but large slanted windows lining the Wandelgang (promenade) gave an excellent view out. Lounge and dining salon overlooked the promenade.



graduated in size from the fat middle to the pointed bow and stern. Holding the rings were 35 flat girders running lengthwise, and an interlocking cobweb of steel wires. It took 5,500 000 rivets just to fasten the rings to the girders.

The Hindenburg was fatter across her midsection than previous Zeppelins: the Shenandoah had snapped in two, indicating the need for strength amidships. But the heftiest framework supported the bow, for it hooked onto the mooring mast and had to hold, no matter how gusty the conditions on the ground.

This giant craft did not fly like a bird or an airplane. It floated in the air. The buoyancy came from 16 separate gas cells—tremendous bags that were shaped like gigantic pairs of pants. From below you saw only the floppy “pants legs.” These gas cells pushed up against the “ceiling” of the airship (a rope net kept cells from chafing against the hull).



Your tour guide would avoid mentioning it, but those gas cells contained 7,000,000 cubic feet of hydrogen, the lightest gas known—and also the most powerfully explosive. U. S. airships used helium, not quite so buoyant but not at all inflammable. Germany had no helium. Already the black clouds of World War II loomed, and Americans were in no mood to supply rare strategic material to a future enemy.

The Hindenburg's designers understood the danger. Chimneylike *Gasschachte* (shafts) vented any seeping hydrogen to the outside of the hull. You caught sight of riggers, wearing buttonless asbestos suits and felt-soled shoes to avoid any chance of static sparks, inspecting those shafts. They also checked the gas cells—they walked right through them along the *Mittellaufgang*, the hull-bracing axial catwalk that pierced the cells by way of little canvas tunnels.

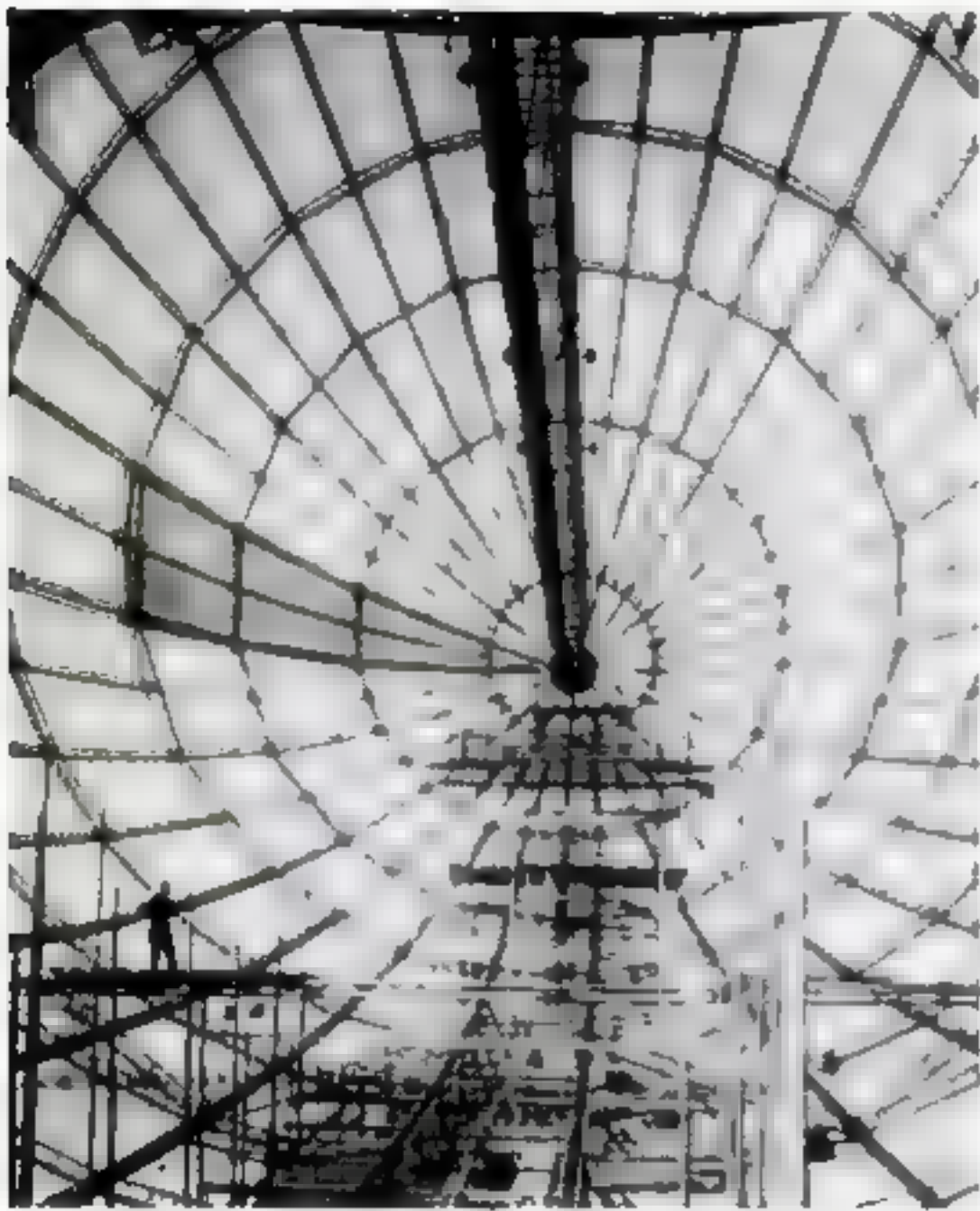
Walking aft past the officers quarters, you came to the

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Führergondel, the control car. Window-walled, roomy, and impressive, it resembled the bridge of a ship.

Right away, you noticed that it took two men to steer a Zeppelin. The rudderman, facing forward, kept her on course with his giant wheel. The elevatorman faced sideways, watching an inclinometer and altimeter to keep her at the charted altitude. The up-and-down steersman had an unusual and valuable instrument: a crude forerunner of today's radar altimeter. It was a compressed-air whistle. By timing the *beep-beep* echoes bounced back from the surface below, he could tell exactly how high he was.

A precise measure of altitude was vital in dirigibles, for they cruised ridiculously low by airplane standards—usually the height above the surface was less than the ship's length. This was a hazard: A vagary of wind might slam the tail down to disaster (the Akron apparently crashed just that way). However, high altitudes were uneconomical: Too



"Tremendous" was the word for the *Hindenburg*. This shot was taken during construction—there's a man on the scaffold at lower left. Huge size was essential to make room for enough gas to lift useful loads, but also required equivalent strength (the *Shenandoah* broke up under stress of wind or violent maneuvers). Here you see lateral rings, riveted to longitudinal girders and braced with steel wire, that made the giant *Hindenburg* rigid.

much gas had to be expelled to come down again.

Beyond the *Führergondel* you came to passenger country. It was spectacular—an amazing replica of first-class ocean-liner accommodations, extending all the way across the width of the ship and one-third the depth up from the keel.

There were two decks. The main A deck had promenades on either side lined with wide, slanting windows and overlooked by a lounge and the dining salon (hot biscuits, baked fresh in the galley, were a specialty).

Off the foyer on A deck was a narrow corridor leading to the 25 *Fahrgasträume*. Each stateroom had two bunks, a stool, folding shelf, fold-up plastic washbasin, mirror, and electric light.

You could even smoke aboard this airship. The bar was sealed off by double doors, which the steward unlocked when you rang the bell. Here the air pressure was maintained slightly above that in the rest of the ship so that no stray hydrogen could possibly leak inside. The smokers lit up with electric lighters (matches were *verboten* anywhere aboard).

If you wanted to take a shower (imagine that aboard a jet airliner!), you went down to the *Badzimmer* on B

deck. It gave a trickle of water until an automatic shutoff unmistakably told you "time's up." Water was too heavy to be carried in lavish supply—they augmented tank storage by collecting rain and dew that ran off the Hindenburg's four-acre back.

Everywhere, ingenious touches economized on weight. Each extra pound meant 13 more cubic feet of hydrogen. You could lift any of the chairs with a finger of one hand. You needed two hands to raise the piano, which was made of aluminum. The partitions—even stateroom walls—were canvas; it was like living in a many-roomed tent.

Beyond the passenger quarters stretched two-thirds of the giant craft. You walked past three crew foc'sles, one major and 14 lesser freight rooms, two dozen lockers for ship's gear, 15 water-ballast tanks, 42 tanks storing 64 tons of diesel fuel.

Each of the four engines—1,100-hp. Mercedes-Benz diesels driving 20-foot four-bladed wooden propellers—was carried with its operator in a *Motorgondel*, a little car hanging outside the hull. You climbed into it by a narrow ladder leading down from the lower catwalk. Inside, the roar was deafening—the telephone connection to the control car was useless, and instructions had to be signaled over an engine telegraph like those in steamships.

The Hindenburg could make 84 knots top, and cruise at 77 knots—not too far behind commercial airplanes of the day. She also had something no airplane ever has—a spare engine stowed in a freight compartment.

At the very stern inside the huge under fin was a retractable tail wheel, similar to one under the control car. At Lakehurst the tail wheel rested on a flat car that rolled around a circular track, allowing the airship to turn with the wind when she was tethered to her mooring mast.

Huge, complex, and beautiful, the Hindenburg was the supreme creation of the Zeppelin builder's art. Safe, too. Her designer, Dr. Ludwig Duerr, had boasted that she was as fireproof as man knew how to make any vehicle of transport.

IF anyone knew how to build and fly airships, it was the Teutons from Friedrichshafen. Count Ferdinand von Zeppelin had built the first practical dirigible in 1900 (these things were giants from the start—old LZ-1 stretched 420 feet). Ten years later he was hauling passengers in the world's first commercial air transport. By the time World



Staterooms were bare and small, mainly to save weight—the ladder to upper bunk was perforated aluminum, washbasin plastic. The fare from Frankfurt to Lakehurst, N. J.—with meals and tips included—was \$400.



No stewardess has it so good today—this was the galley on the Hindenburg

War I shut down the *Deutsche Luftschiffahrt A.G.*, it had established a most respectable record: 34,228 passengers, 144,000 miles, no deaths, no injuries.

The Germans flew 72 Zeppelins during World War I and sent them on 311 bombing raids. The bomb casualties in England alone came to 1,882 people, not counting a very substantial number hurt by falling shells from the Britons' own

ack-ack. The biggest of these warcraft, the 700-foot L-72, was poised to cross the Atlantic and strike New York, but peace came just in time.

The victorious Allies, impressed by this record, took over the *Luftschiffabteilung's* Zeppelins, and rushed to build more of their own. A decade and a half of disaster followed.

In 1921, the ZR-2, built for the U.S. Navy by the Royal Airship Works in England, broke its back and burned, killing 62.

In 1923, the Dixmude (the old L-72, seized and renamed by the French) disappeared on a flight to Africa. The only trace ever found was the body of her captain, Commander du Plessis de Grenedan, pulled out of the Mediterranean by fishermen.

In 1925 the Shenandoah, an American-made copy of the German L-49, broke up in a squall over Ohio, killing 14.

In 1930 the R-101, pride of Britain, exploded against a hillside at Beauvais, France, killing 47 (including the Secretary of State for Air, the Director of Civil Aviation, and most of the Empire's airship experts).

In 1933 the U.S. Navy's Akron, which could launch airplanes like an airborne aircraft carrier, plunged into the Atlantic off Barnegat, N. J., killing 73.

In 1935 the Macon, sister ship to the Akron, broke her stern and fell into the Pacific, killing two.

That did it for everybody except the Germans. Back in Friedrichshafen things had gone swimmingly.

In the autumn of 1928 the Graf (Count) Zeppelin—the LZ-127, 774 feet long, weighing 66 tons, able to haul a payload of 20 passengers and 13 tons cargo—inaugurated commercial service. She followed a southern track to America, averaging not quite 60 miles an hour: 6,000 miles from Friedrichshafen to Lakehurst in four days and 16 hours.

The *New York Times* gave nearly 10 pages to the story.



A tragic record of crashes discouraged other nations from competing with the German Zeppelins. Above you see the remains of Britain's R-101, stretched out in death like the skeleton of some strange giant fish. Heavy and unstable in stormy weather, it dropped against the side of a hill and exploded.

The following year the Graf flew around the world. In 1930, service to South America began. By 1936, she had transported 13,000 passengers on 575 trouble-free flights.

Yet the crews became unbelievably careless. They smuggled contraband. They even sneaked cigarettes on catwalks, hiding behind bags billowing with touchy hydrogen.

On one journey from South America, crewmen secreted monkeys in the hull. The monkeys escaped and swung, chattering and scolding, from girder to girder until the ship landed. Another time, tropical fruit, tucked high in the framework, dripped sticky juice on all who passed below. Cameras and radios, a special hazard because they might contain spark-causing batteries, were conveniently concealed in the folds of the floppy gas cells.

Nonetheless, the Graf's phenomenally charmed life held (she and the U.S. Navy's Los Angeles, also German-built, were eventually dismantled). The Graf was west of the Canary Islands, homeward bound from South America, as the Hindenburg prepared to moor that thunderstormy afternoon 25 years ago.

AT Lakehurst, Lt. Raymond F. Tyler and Chief "Bull" Tobin—both lighter-than-air pros—directed the ground crew. They had rolled out the 75-foot tripod mast and deployed the line handlers.

Theirs was a delicate task. It was up to Kapitän Pruss to "weigh off" his Hindenburg: get it nearly level and aerostatically balanced by valving off or adding gas into the various sections, depending on whether the ship needed to be heavier or lighter. But even after a perfect weigh-off, it took more than 200 strong men to haul the balky colossus down from the sky. Troops from Camp Dix had been drafted to help 138 civilian and 92 Navy linesmen. The least gust of wind could—and often did—send the airship bounding like a kangaroo hundreds of feet skyward. On other occasions rope handlers had been lifted before they could let go, then dropped to their doom.

CONTINUED

Nine Famous Airships



LZ-1, first of the Zeppelins, was launched in 1900. It flew at a breathtaking 18 m.p.h.



R-34, British-built, flew Atlantic in 1919, one month after an airplane first made the trip.



Shenandoah, made in U.S. in 1923, pioneered use of helium. It crashed in a storm in 1925.



Los Angeles was built by Zeppelin works in Germany for U.S.—a war-reparations payment.



Norge, Italian-made, flew over North Pole in 1926. Unlike Zeppelins, it lacked full frame.



Graf Zeppelin began its long commercial career in 1928. It made trip around world in 22 days.



R-101, built by British Government for passenger service to East, crashed on maiden voyage.



Akron and Macon were sister ships of U.S. Navy. The Akron crashed in 1933, the Macon in 1935.



Hindenburg, the biggest of them all, completed one successful season before disaster struck.

100 200 300 400 500 600 700 800
FEET

The Hindenburg swept in over the south fence at a brisk 73 knots, 590 feet high.

"What a sight it is!" exulted Herb Morrison, the Chicago radio commentator who was making an eyewitness recording on the field. "The sun is striking the windows of the observation deck and sparkling like glittering jewels on black velvet..."



It took more than 200 men to haul the Hindenburg down and hold it. Soldiers and sailors helped civilians who got a dollar an hour for this dangerous work.

Kapitän Pruss crossed the field and turned to come in, valving gas from forward cells, dumping water ballast from the stern, shifting crewmen for an exact balance.

At 7:21 p.m., the first handling rope hit the ground.

In the passenger compartment, photographer Otto Clemens leaned out a window and worked his Leica to record the action below. He did not know it until his film was developed days later, but his negative showed flame reflected in rain puddles on the ground.

A bystander, Cage Mace, recalled later, "A shower of sparks shot up from the top of the bag and to the rear, followed instantly by a column of yellowish flame..."

Above, passengers tumbled, one atop the other, a mass of shrieking, crying people.

Joseph Spah, the acrobat, knocked out a window, climbed through, and dangled outside by one hand. When the ship started falling, he dropped—hard enough to bounce.

Miss Mather was pulled out of the crumpling, flaming cabin by ground crewmen.

Frau Kleeman just walked down the debarkation stairs.

In half a minute, 35 people were killed or fatally hurt.

Even today, 25 years later, your back chills when you listen to the recording of newscaster Morrison's sobs: "... Get this, Charlie, get this. Charlie... It is burning... Oh, the humanity and all the passengers!"

MORE than humanity perished that warm May evening. It was the end of an era. The great airships had become a part of history.

Official investigations arrived at the "least improbable" conclusion: Static electricity had ignited leaking hydrogen. This verdict was not very convincing then, and is less so now. New evidence points to sabotage by a crew member allied with the Communist anti-Nazi underground (it's a complex story detailed in the book *Who Destroyed the Hindenburg?* by A. A. Hoehling, Little, Brown & Co., Boston).

But one more Zeppelin flew, the LZ-130. She cruised the



English Channel, ferreting out British radars before World War II, but was ignominiously scrapped for her aluminum.

If you visit Friedrichshafen now, you can see the ruins of the *Luftschiffbau*, leveled by bomb attacks. Weeds wave above rubble-jagged headstones of the Zeppelin's own burying ground.

Until his death in 1960, Max Pruss had campaigned for a new airship company. He came close to winning approval for a 150-passenger Zeppelin even bigger than the Hindenburg.

In the United States, Prof. Francis Morse of Boston University has blueprinted an atomic-engined dirigible—without much encouragement from anyone who might build it.

The plain facts of transportation explain why. A jet airliner can fly the Atlantic in six hours instead of 60. It can carry three times as many passengers each trip as the Hindenburg did. It costs only a fraction as much to build.

The biggest birds that ever flew are gone—extinct as dinosaurs and pterodactyls, and no more likely to return. ■■

*This was the end
Before the eyes of
hundreds of horrified
spectators, the
Hindenburg exploded
into flame at 7:25
p.m., May 6, 1937, as
she moored after a
transatlantic crossing.
It was all over in
32 seconds.
Zeppelins were kaput.*

The Other Fellow's Job:



Hot-brick builder

Ceramics is a growing field, especially in the steel industry. Keith Karl Kappmeyer, a tall, 28-year-old former Chicagoan, is one of about 100 ceramic engineers in steel.

Kappmeyer works in the U. S. Steel research labs in Monroeville, Pa., in a unit consisting of three other engineers and six technicians. His job is to check refractory (heat-resisting) materials purchased by the company and to develop new and better materials.

He first became interested in ceramics while a student at Bloom Township High School in Chicago Heights. In a school exhibit he saw the many amazing forms of ceramics—missile cones, abrasive disks, porcelain kitchenware, refractory bricks. That decided him. He tried for and won a scholarship in ceramic engineering at the University of Illinois.

Kappmeyer is married and has two daughters, three and five. A specialized engineer of his experience earns \$7,000-9,000 a year.



He X-rays rockets An undetected void or fissure in a rocket's solid-fuel charge could mean premature burn-through and failure. Bob Hunsaker's job is to X-ray these fuel charges with the 8,000,000-electronvolt linear accelerator shown here or with a 1,000-curie cobalt-60 camera. He is one of 15 radiographic technicians employed by Thiokol Chemical Corp.'s Wasatch Division in northern Utah, where the booster stage of the Minuteman ICBM is built.

The fact that he works in a potentially

dangerous radiation field doesn't bother Hunsaker. He knows that no Thiokol employee has ever acquired anywhere near the maximum safe dosage of radiation established by the Atomic Energy Commission.

Hunsaker's favorite sports are golf, fly fishing, and skiing. And, he says, there are few places in the world better for these sports than his own "back yard"—the Wasatch Range of the Continental Divide. The 27-year-old bachelor can afford his weekends in the great outdoors with no trouble, his yearly salary is about \$7,000.

The probing wit of a famous French biologist casts light on

The Substance

Amusing, sharp, thought-provoking—the comments of Jean Rostand will give you an unexpectedly fresh view of yourself, your neighbors, and every other human. The excerpts on these pages are adapted from his

new book, *The Substance of Man* (Doubleday & Co., \$4.95). As a biologist, M. Rostand has won professional renown—including election to the Académie française—for his pioneering work on mutations in

“The hereditary combinations capable of arising from the union of two human beings is not less than several hundred trillions. A single couple could give rise to enough offspring—no two alike—to people several planets.

For the biologist there are no classes—only individuals.

I do not know what man is made of; but what I think I do know is that it is a poor stuff and one that gets worn out in the span of a life.

All human diversity results from the virtually infinite combinations of genes. All of us are formed of the same

chromosomal dust; none of us has a single grain of it that he can claim as exclusively his own.

We never bequeath more than half of ourselves, and our children do not carry us on by more than half. Immortality by means of offspring is only half an immortality.

Germ cells are not interested in the individual's life experience; they keep no record of it. We transmit nothing but what we have received from our parents, adding nothing of our own to the heritage.

Nothing that man has learned through the centuries has

of Man

frogs and toads and on the artificial stimulation of fatherless birth. He is equally well known as an author and has published more than 50 books in fields ranging from moral philosophy to the lives of animals

PHOTO FROM THE JACKET OF "THE SURVIVANCE OF MAN"



entered into his flesh. If civilization were destroyed tomorrow, and man had to begin again, his starting point would be the same as one or two hundred thousand years ago. All his work, all his suffering would count for nothing.

Young ants, isolated from the home colony, reproduce it to perfection. But young humans separated from their kind would be unable to rebuild the human colony save in its lowest foundations. Ant civilization is inscribed in reflexes. Human civilization is found in libraries, museums, codes.

The only boast man can claim: that nothing more complicated

than he is to be found among molecular groupings.

Nature has no favorites, and man, in spite of all his genius, has no more value for her than any of the millions of other species.

The ant has no idea it is nothing but an ant; but man knows he is only man.

The essential for a scientist is clear perception in his own domain; who cares if Pasteur did not believe in evolution?

Though it may not have an answer for everything, science will, perhaps, give us a remedy for everything.

THE SUBSTANCE OF MAN CONTINUED

The best of science is not necessarily the most efficient. Up to the age of Pasteur, "healers" did more healing than doctors.

A great writer is a man who knows how to surprise by telling us what we have always known.

Since the discovery of atomic disintegration, it has become incumbent on humanity to live under threat of death. Why shouldn't the feeling of lethal danger, which is so productive for the individual, be so for the species, as well?

Let us be grateful for the chaos of life: it diverts us from the horror.

Scientific truth does not generally reach the majority of men until it has ceased to be true.

The younger the subject, the livelier the process of aging. The person who ages least rapidly is the old man.

A man is not old as long as he is seeking something.

Tomorrow our children will be experimental material. Their sex will be predetermined, their physical and moral personalities will be designed by dosages of hormones. For my part, I prefer to have lived in the barbarian age when parents had to be satisfied with the gifts of chance, for I doubt that these rectified and calculated children will evoke the same emotions as do our present variety, fortuitous, imperfect, and disappointing as they are.

Science had better not free the minds of men too much, before it has tamed their instincts.

The human species will pass as the dinosaurs passed. Little by little our sun will lose its light and heat Then, of the whole civilization, human or superhuman—its discoveries, philosophies, ideals, religions—nothing will persist. There will be less vestige of us than we today possess of Neanderthal man.

Every man is my brother as long as he keeps his mouth shut.

New Lure Is Self-Propelled



Tiny propeller is only $\frac{3}{4}$ " in diameter. Miniature stern rudder can be turned to any angle to steer the buzzing lure.

IT'S hard to make fishing much lazier than it already is, but they've found a way. Now you hitch your line to a mechanical lure and send it out to fish for you while you sit back and relax.

It's no fish story. A new battery-powered lure has a tiny built-in electric motor and propeller to send it scooting along underwater. About 5" long, it looks like a miniature torpedo studded with fearsome three-prong hooks.

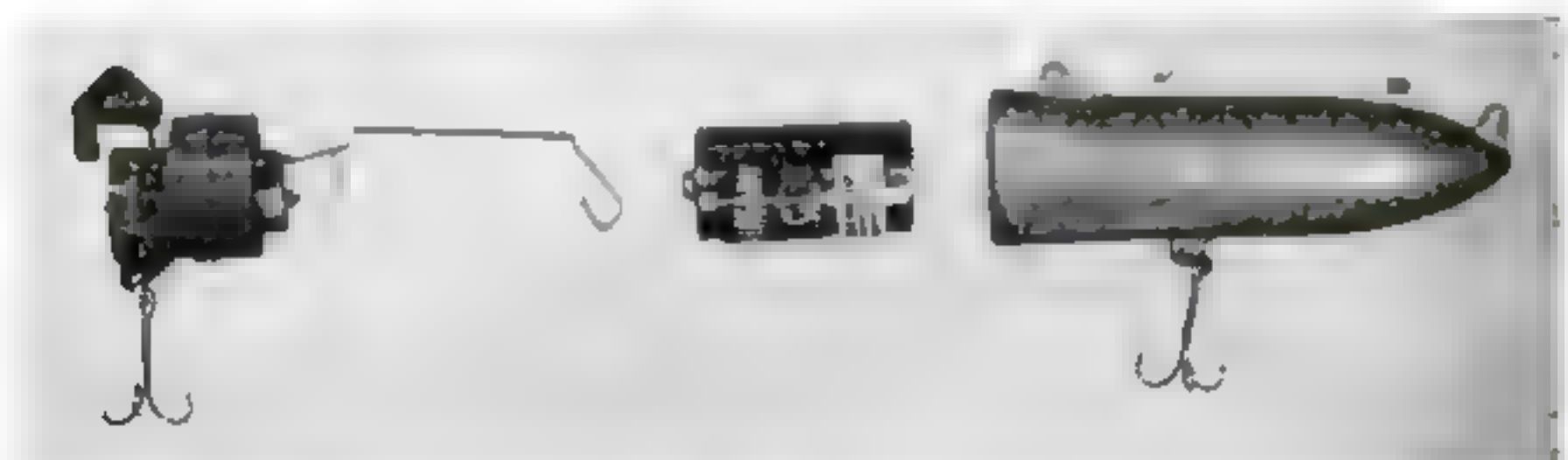
There's even a tiny rudder to steer the fish finder wherever you want it to go. It will sweep wide, leisurely circles around a boat or head straight out for that favorite patch of hly pads you can't quite reach from shore.

The lure is suspended from a small bobber float of the kind used in still fishing. You can adjust it to "cruise" at

any level, depending on the fish you're after and the depth of the water. When an unsuspecting quarry makes a grab for its mechanized meal, the bobber tells you it's time to stop yawning and reel in your catch.

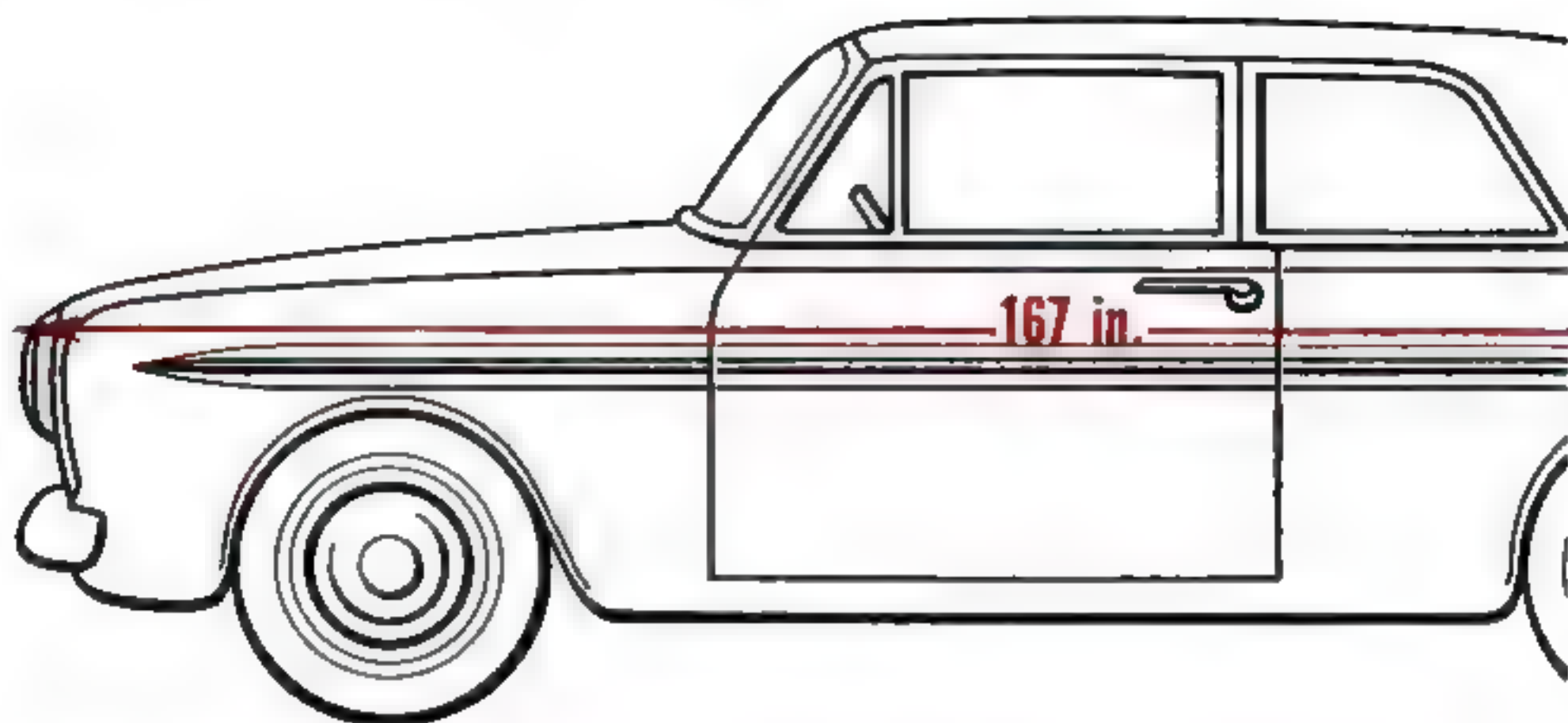
The line is attached to the lure by an adjustable bridle that allows you to balance the mechanism so it rides level in the water. An on-off switch is concealed inside the soft plastic housing. It is controlled by simply squeezing the nose of the lure.

The lure is made by Presto Dyechem Co., Inc., 45 John St., Yonkers, N. Y. Price: \$4.95. The soft purring sound of the motor is said to cast an enticing spell that the fish can't resist. And neither, bets Presto, can the gadget-happy fisherman.



Squeezing the nose presses a contact strip against a single C-size dry cell that runs the

lure. Fish charmer is swivel-linked to a balance line through which fisherman controls it.



Cardinal looks something like German-produced Ford Taunus. Wheelbase is 99.5 inches,

What Ford's New

By Devon Francis

FROM Dearborn, Mich., home of the great Ford Motor empire, and from Cologne, Germany, the site of a Ford subsidiary, there leaked last month the first tangible details on the company's new Volkswagen-size car.

This four-passenger automobile will be in the showrooms before the frost is on the pumpkin. Variouslly dubbed the Cardinal—Ford's code name—as well as the Fairlane IV, Falcon IV, and Hummingbird, the car will sell for \$1,650, including federal excise tax, but without the cost of shipping from the factory and the customary dealer handling and preparation charges. Probable retail price (not counting freight): slightly in excess of \$1,700.

That will be \$100 more than the Volkswagen sells for at the New York port of entry. It will be \$150 less than Ford's compact, the Falcon, in its austerity version.

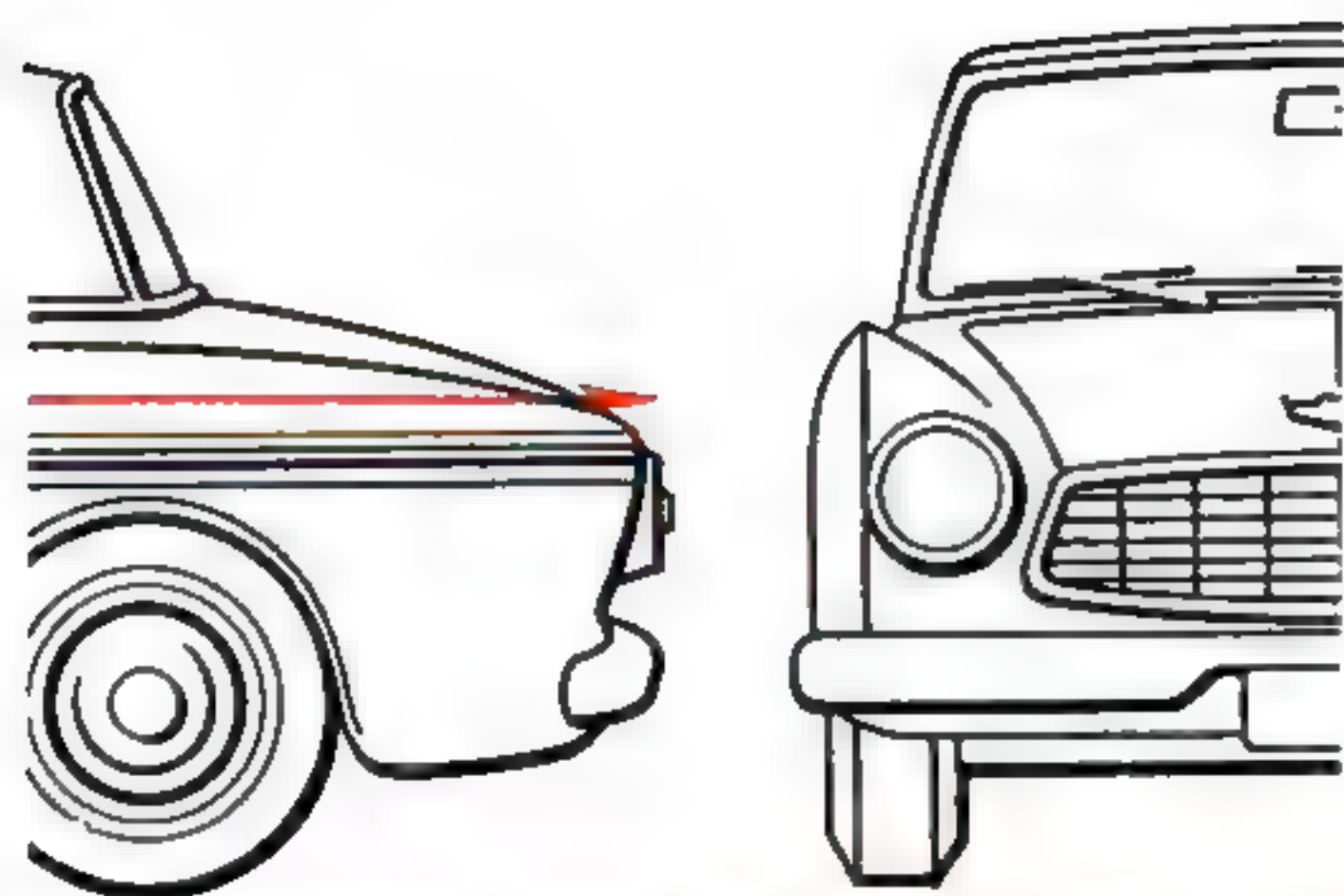
The Cardinal will register two firsts in U. S. auto history—it will be powered

by the first V-4 engine ever put into a nonmilitary vehicle (American Motors produces a V-4 for the military services), and it will have the first U. S. front-wheel drive in a quarter of a century.

The Cardinal engine is tiny. The four cylinders have a total piston displacement of only 91.4 cubic inches. That compares with 72.74 cubic inches for the VW and 144 for the Falcon. For contrast, the Chevy II's four cylinders displace 153 and the boisterous Pontiac Tempest's 194.5.

The Cardinal's cast-iron engine is over-square—the bore is 3.54 inches and the stroke 2.32. The compression ratio of 8.5:1 is .2 less than that of a Falcon but 1.5 more than that of the VW engine. Sixty degrees separate the two cylinder banks. The valves are overhead. It is water-cooled.

The horsepower output is 52, which compares with 40 for the VW and 90 for the Falcon. At a car weight of 1,672 pounds, each Cardinal horsepower is required to tote 32.1 pounds of car, not counting passengers. That compares



* **The Cardinal is a ghost**

STOP PRESS: In the middle of this press run, and as Automotive Editor Francis was packing to test-drive the Cardinal in Germany, Ford phoned us: The car was shelved. Probable reasons: a drop in midget-car popularity, cost, fear of hurting Falcon.

length 167 inches (making it the shortest U.S.-made car on the market), height 54.5 inches.

WOULD HAVE BEEN **Little Car ~~Will Be~~ Like***

with 40.7 pounds for the VW and 27.2 for the Falcon.

The Cardinal engine produces .56 of a horsepower for each cubic inch of displacement, compared with .55 for the VW engine and .62 for the Falcon's.

The most startling aspect of the engine apart from the two-bank design is the cooling system. All water-cooled engines employ a fan to pull air through the radiator at idle and low car speeds to prevent overheating. The Cardinal engine does this, too—now and then.

The V-4 is cooled by a small, conventional radiator set behind, instead of in front of, the cylinder block. To save space in the engine compartment, and also the power required to run a fan off the crankshaft, the engine water is cooled for the most part by ram air, the result of car speed.

If the engine builds up too much heat, however, a thermostat turns on a small electric motor that whirls an equally small fan. The main function of this fan is to distribute air for heating the car interior in cold weather—which is to say

that the radiator serves both to keep the engine cool and as a heat exchanger.

Fuel consumption? Ford Motor is aiming at 30 honest miles per gallon.

The transmission has three speeds, synchronized in all gears.

At 167 inches overall, the Cardinal will be the shortest domestic car on the U. S. market. The next biggest is the Rambler American, at 173 inches. The VW measures 160, the Falcon 181.

Due to the front-wheel drive, like those of the Swedish Saab and the French Citroen DS-19, the weight on the Cardinal's front wheels is disproportionate by U. S. design standards. A distribution of 55 percent on the front and 45 on the rear is common here. The Cardinal's front wheel load is 1,015 pounds, or 60 percent of the entire car weight.

Yet the front suspension is copied directly from the old Ford Model T. It is an extra-heavy, single-leaf transverse spring.

Despite its modest horsepower, the Cardinal is capable of 70 miles an hour with two persons aboard.



Only 90 hours after the new ship docked, her harbor welcome is pictured on the famous Colorama.

How the S. S. France steamed into Grand Central

Whistles shrieked a greeting and fireboats became floating fountains when the world's longest luxury liner—the France—glided into port recently on her maiden voyage. Not all the excitement was down at the French Line pier; some of it spilled over, unexpectedly, into New York's Grand Central Station. Tourists and commuters, hastening through the vast main concourse the following Monday, did a double-take when they glanced up at the Colorama—a mammoth photograph, changed every three weeks—that's been a familiar fixture there for the past 12 years.

A new illuminated transparency had appeared during the night. Now, stretched

high across the end wall of the station was the majestic France herself.

Processing a Colorama shot usually takes three to four weeks, and photographers often shoot the pictures a year in advance. Kodak telescoped the time into four days—from the Thursday when the France sailed up the Hudson to Sunday, when the transparency was spooled and trucked to Grand Central. To install it, the Colorama's big side frame was swung aside, clearing the track for a flatcar to run in front of the light-box, with the spool held vertical.

The France's captain attended Monday's unveiling before heading back to sea.



Lights burned through weekend at Rochester plant as processors raced the clock. Final transparency had to be printed and developed

in 41 strips, each 18 inches by 18 feet. Crew at right is retouching; men at left cut and match strips for perfect register at butt joints.



Man-powered plane built by Hatfield team tries its wings.



Southampton plane's pedal-pusher sits up front for hard work.

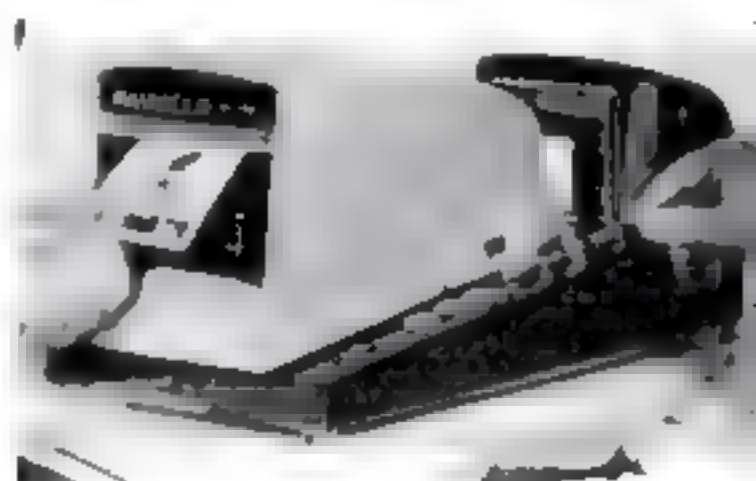


First flight of Southampton flying bicycle was 210 feet.

Winged bicycles take to the air

Two pedal-driven planes (left) have taken to the air in England. One, built by a team at Hatfield headed by de Havilland's aerodynamics chief, has flown a quarter-mile at heights up to five feet. The other is the work of students at Southampton University.

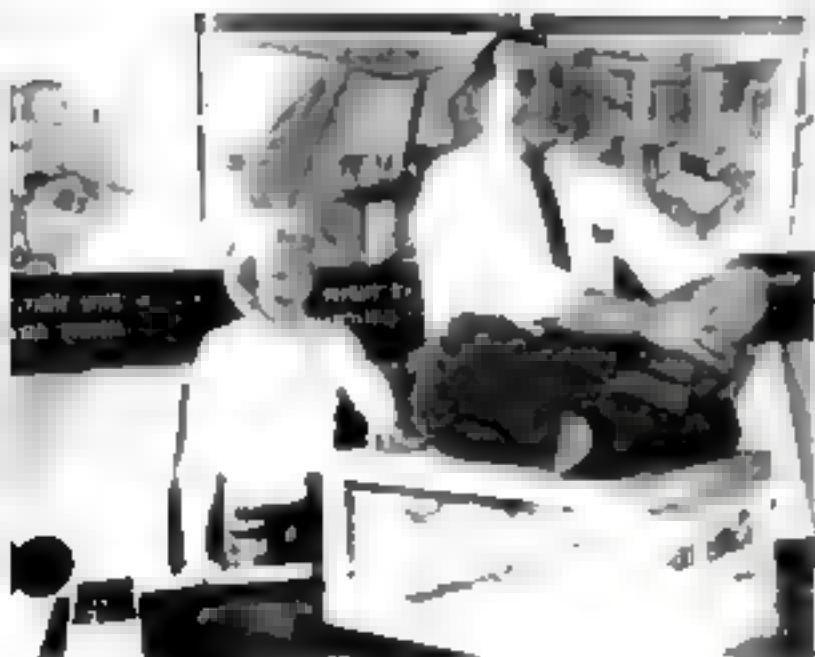
Both planes look like out-size gliders with a wide wingspan and a pusher propeller above the fuselage. The Southampton students figure pedaling has to develop three hp. for takeoff and $1\frac{1}{2}$ hp. to stay in the air.



Color photos printed without a darkroom

A three-minute color process is built into a machine the size of a slide projector. The printer is used in light, has a miniature computer that determines color balance and exposure when set for the emulsion. Pavelle Corp., New York City, will market it this winter for under \$200. A lower-cost model needs a darkroom.

The process requires only two solutions—a developer and a bleach fix—followed by a single wash. Enlarged $2\frac{1}{2}$ -by-3 $\frac{1}{2}$ -inch or 3 $\frac{1}{2}$ -inch-square commercial-type prints can be made from 35-mm, 120, or 127 negatives.



Air-cushioned conveyer

Using a new conveyer system, this 100-pound girl finds it easy to push a 300-pound crate with a 200-pound man sitting on it. Like the now familiar ground-effect machine, the load rides on a cushion of air. But unlike earlier machines, the air doesn't come out of the box. Instead, it comes from the floor underneath the cargo.

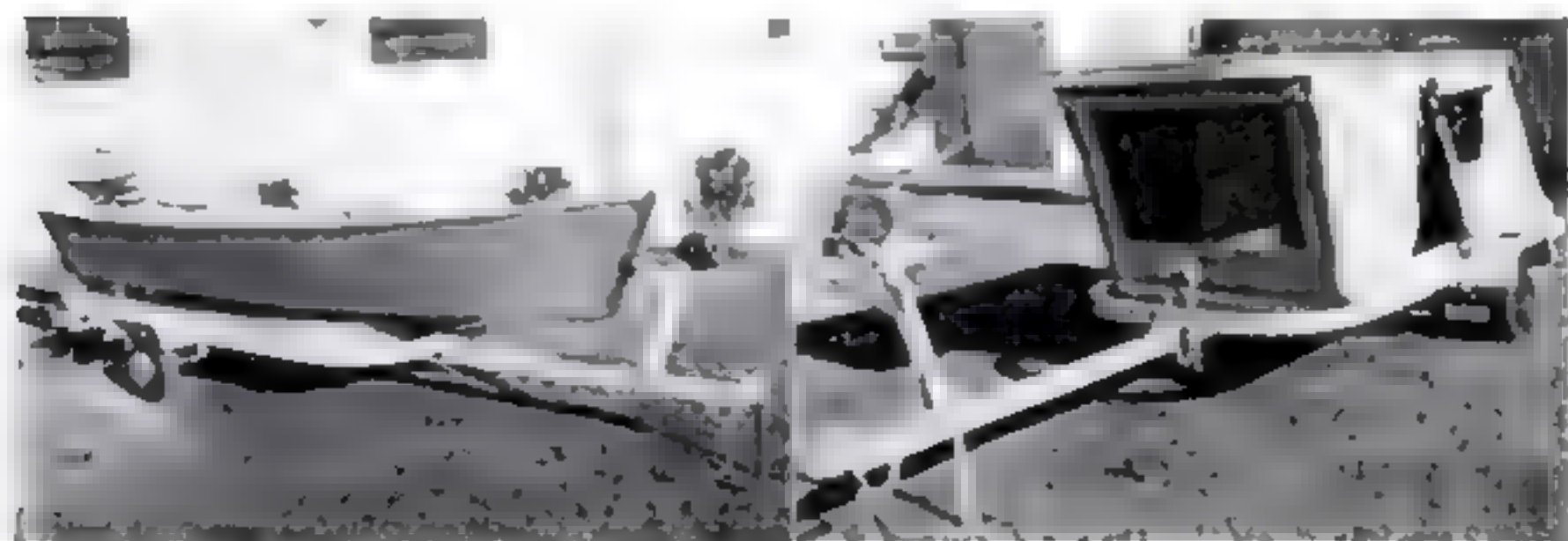
Bell Aerosystems is perfecting a method by which jets of air issuing through holes in a floor support heavy loads by raising them a fraction of an inch. The air spurts through pressure-sensitive valves that open when the load is over them, close when it moves off.



Swimming pool helps fight fires

A new build-it-yourself swimming pool comes equipped with an 8-hp. pump and 100 feet of fire hose that will play a stream of water for several hours. It's especially useful if you live on property away from the services of a fire department. The pool-and-pump combination was developed by Cascade Pools, Edison, N. J., and Thor Research Center, Huntley, Ill.

A hose permanently connects the pump to the drain of the 16,000-gallon, 16-by-32-foot pool at the deep end of its plastic liner. Besides a five-gallon, LP-gas-fired pump, hose, and materials for building the pool, the kit contains two nozzles, a fire axe, shovel, broom, bucket, and a small shed to house the equipment. It costs \$2,095 complete.

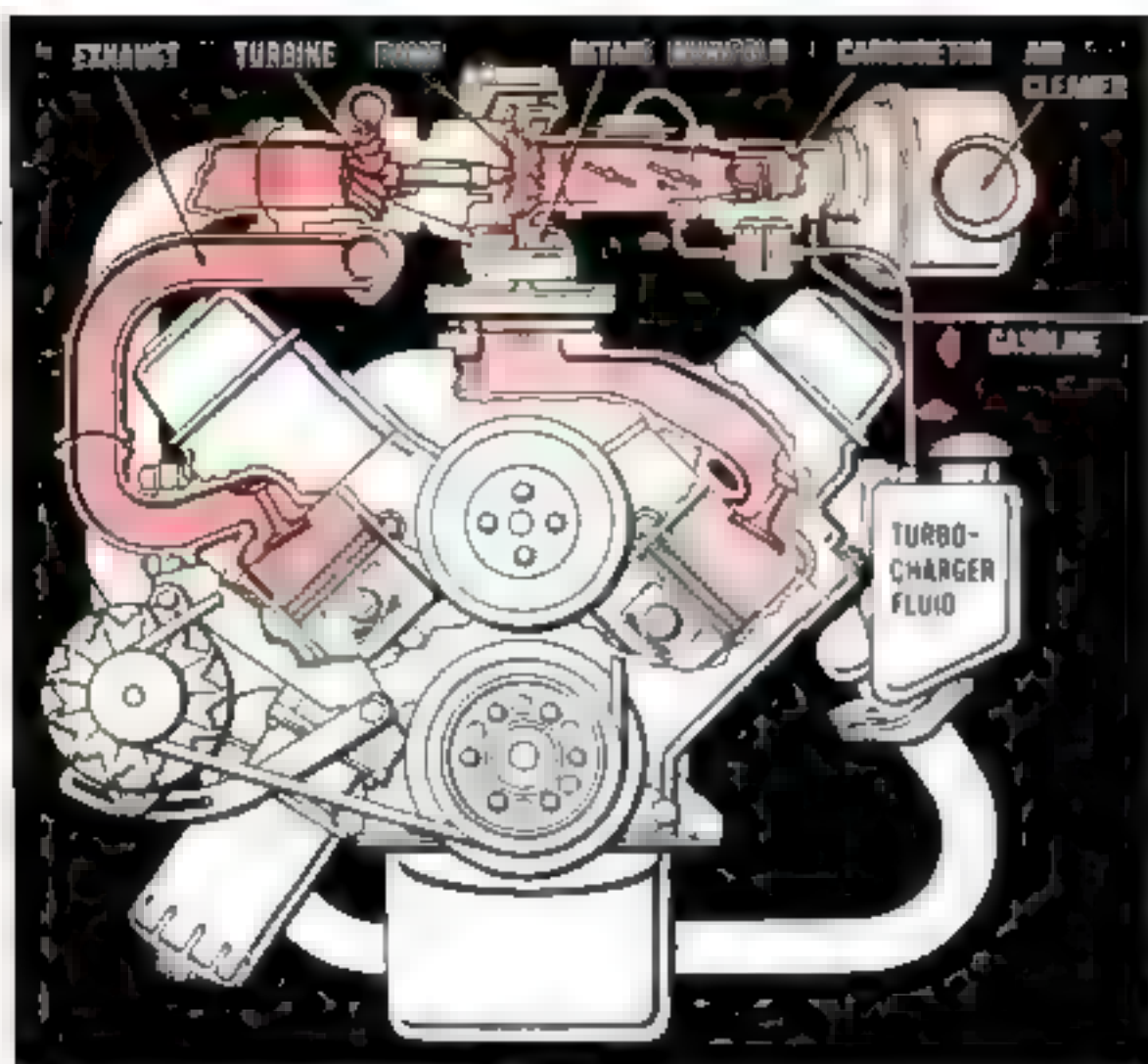


Double-duty boat trailer

This combination tent and trailer will haul your boat to the water's edge where you can unfold it to provide sleeping quarters for two. As a trailer, it will accommodate boats as large as 14 feet.

When you've loaded it aboard, the boat

rests on rollers over what looks like a plywood deck. Once the boat is launched, you can raise the deck and prop it up to form a roof over an unfolding canvas tent. Netting windows keep out insects. A floor underneath can be covered with a mattress. Cox Trailers, Grifton, N. C., sells the combination for \$399. The mattress is extra.



Dash gauge shows when supercharger is pumping, lights up when fluid runs low. Left: paths of intake and exhaust gases, and of water-alcohol mix.

Water Cools F-85 Supercharger

LATE last summer Oldsmobile announced a new kind of engine supercharging for its perky compact, the F-85. Last month, after enough delays to orbit an astronaut, the supercharging system shyly appeared.

It was, in truth, new. Unlike Chevy Corvair's, brought out in March [PS, Apr., p. 77], it did not require a reduced compression ratio to control knock. The secret: water, injected into the fuel-air mix, to cool the combustion chambers.

Olds retains the 10.25:1 compression ratio it uses on its 185-hp. engine, but now pulls 215 hp. out of the same eight cylinders. That's one horsepower for each cubic inch, or a hair less than that achieved by the supercharged Corvair. Corvair's power increase over its 102-hp. engine is, however, more spectacular—47 percent against Olds' 16 percent.

Like Corvair's, Olds' supercharger is driven by a turbine whirling in the exhaust stream. It rotates at a higher speed—a top of 90,000 r.p.m. compared with the Corvair's 70,000.

The water—actually a water-and-alcohol mix to keep it from freezing in cold weather—comes from a five-quart bottle

under the hood. Its purpose: to absorb heat. Becoming steam, it picks up heat from the higher cylinder pressures that the supercharging induces. That takes care of knock.

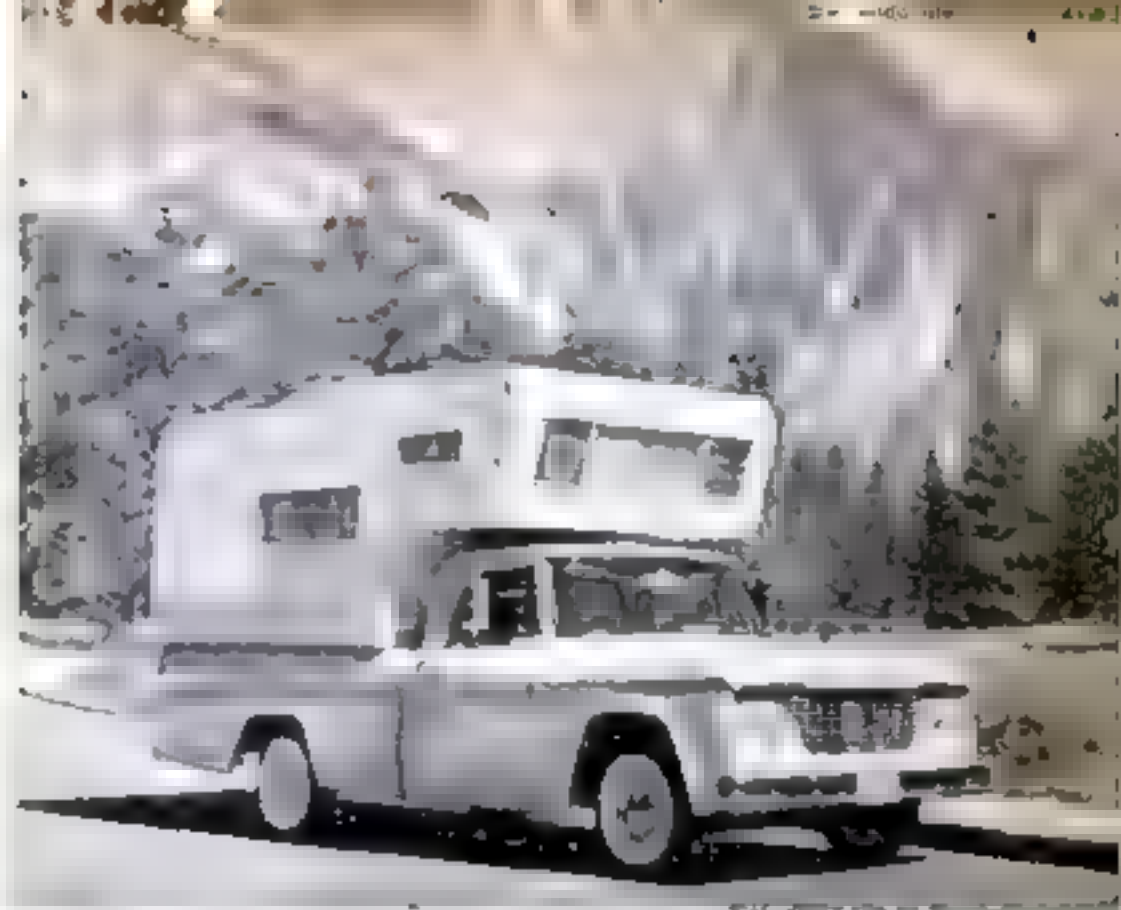
The Olds supercharger is more complex than the Corvair's. It incorporates an intricate control valve. The valve starts the flow of fluid from the bottle when cylinder pressure goes up one pound per square inch, and meters it into the air-fuel mixture ahead of the compressor. The exact quantity depends, of course, on how far and how fast the accelerator goes down.

All this sounds a bit simpler than it is. Remedies for several emergency situations had to be engineered into the system. If the bottle begins running out of fluid, for instance, a light glows in a console before the driver. If he ignores it and the bottle goes dry, a float dropping to the bottom of a reservoir in the control causes a series of diaphragms to open a valve. The valve vents the air-gas mixture between carburetor and compressor, and limits the added pressure to one pound per square inch. That's not enough to hurt the engine.

Your Car and Your Vacation

**30 pages
of fresh ideas to
get—and keep—
you rolling**

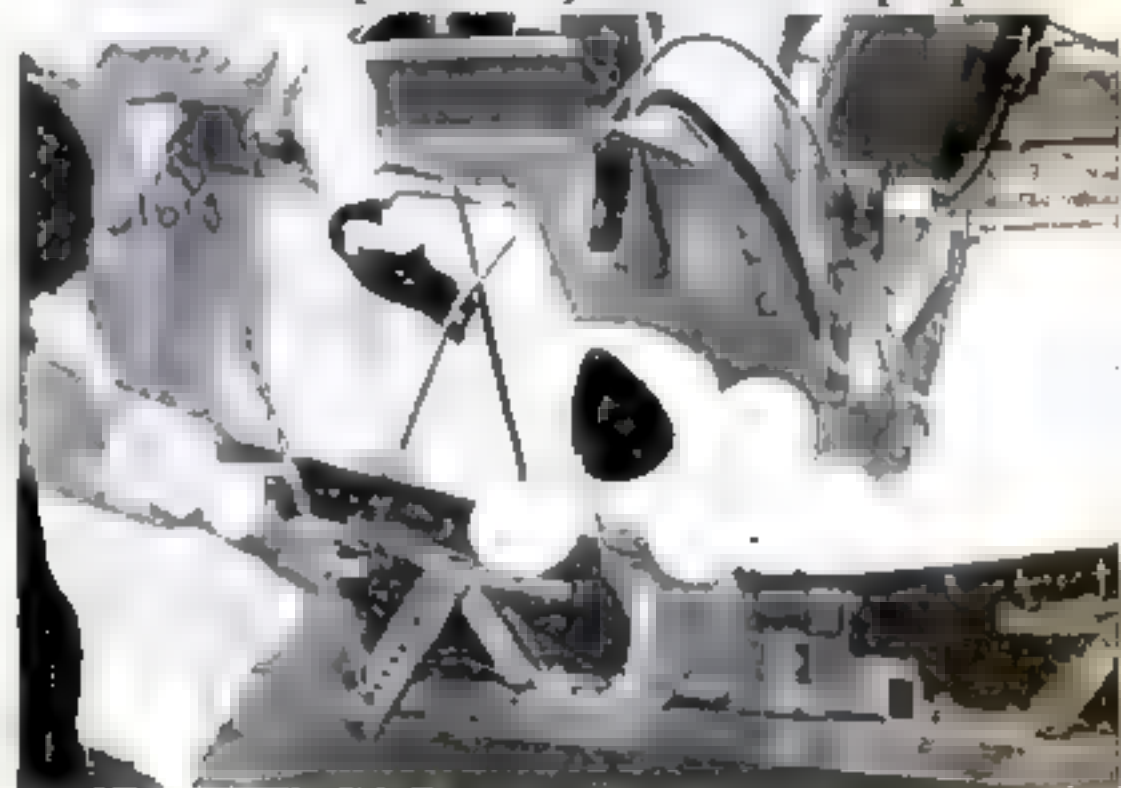
- **New Thrill—Get off Main Roads**
- **How to Avoid Tire Troubles**
- **New Products for Camp and Travel**
- **Carrying Your Camp on Wheels**
- **What Overload Shocks Can Do**
- **7 Tips on Towing a Trailer**
- **Will Rain Dampen Your Campin'?**



When the open road calls, here's one answer



Tired of turnpikes? Try this—but be prepared



Lash it down right and it won't bounce

This was home for 18,000 miles of roving



Off-Highway Driving

...it's fun when you know how

Tired of drab, congested superhighways? Unpaved back roads and dirt trails offer new adventure. But before you travel them, learn the driving tricks the pros use



Large rocks and other movable obstacles in your path should be rolled aside. Don't risk driving over them, a punctured gas tank or oil pan could strand you till help arrives.



Roads that cross streams are usually safe. But be careful after a heavy storm or during flash-flood season. A storm 100 miles away can quickly swell a rivulet to the danger point.

By Alex Markovich

THE four-lane road is smooth and straight—and monotonous. Along the shoulders the trees and shrubs have been slashed back to make room for an unending wall of billboards.

Then, just ahead, you see a tiny side road wandering off across country. You peel out of traffic and jounce onto it. Playing an impulsive hunch, you figure that this cow path has something special to offer—an ideal camping site, a well-stocked mountain stream, or some rough-cut scenery made to order for color slides.

How smart is this growing trend among drivers who are bored by main drags, irritated by traffic, or simply out for adventure? How many byway explorers get into trouble?

Those in the know—police and rangers,

desert and mountain guides, test drivers and the American Automobile Association—all agree that a cautious motorist is practically as safe on an unholed trail as he is on a main highway. Then they hasten to pour on warnings. Collectively the do's and don'ts of the lonely road are enough to frighten an astronaut. But they're not intended to scare drivers off. They're offered as a reservoir of savvy to make your offbeat excursions as rewarding as possible—and to tap in rare emergencies.

Know what you're getting into. If you can, look into road conditions *before* you start out. Local residents can give you valuable information. So can maps distributed by the Geological Survey, Department of the Interior, Washington 25, D.C., which show the topography of undeveloped areas.

Avoid going alone. If it's not possible



Ruts are a problem for low cars. Drive with wheels on one side of the car atop the hump.

to take two vehicles, you can at least let someone (preferably state troopers or park rangers) know where you're going and when you'll return.

Remember that a small back road is likely to be more dangerous in, say, Utah than in Vermont. It's hard to get far away from civilization in the Northeast, even on back roads. But in the West it's another matter. Except in desert country, never head onto an isolated road when daylight is running out. At all times, check unfamiliar dirt roads for fresh tire marks. Rangers in Death Valley actually dust away tire tracks from side trails every few days. Then, when they see a fresh set of tracks, they investigate to make sure no one is stranded.

Gravel roads call for slow driving. Many a gas tank has been punctured by flying stones. Don't start down a steep slope without checking first on foot. The ribbon may end in a dry wash, and backing uphill on loose stuff is tough. If you get trapped into it, and if the wheels chatter badly, try ballasting the trunk with rocks.

Emergency gear that can save your life: Take along a sleeping bag, water, food, flashlight, first-aid kit, tow chain or nylon tape, folding spade, tire chains, tire-repair kit and pump, and flares. In hot weather, a wide-brimmed hat is essential. A tent, folding stove, fiber-glass repair kit, and two jacks (bumper and axle) can also come in mighty handy in lonely areas.

If you're towing a camping trailer, follow this scouting-ahead procedure whenever the going looks dubious: Unlatch the rig, drive a reasonable distance, and then return. Snaking a trailer backward around tight curves is a job you'll never forget.

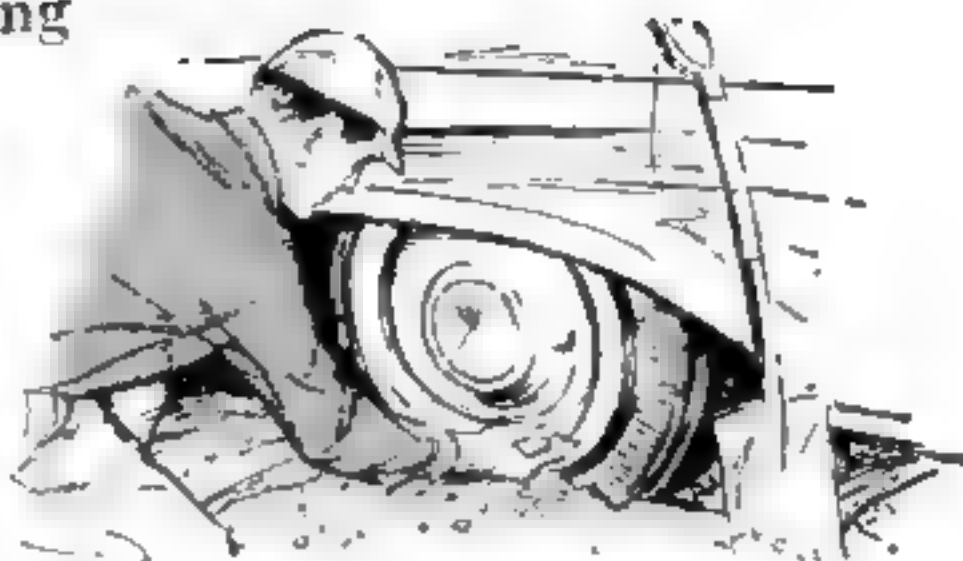
Have a good idea of your car's minimum ground clearance. One trick is to visualize clearance in relation to a fa-



Four tips for safe back-road driving



Fallen branches are frequent obstacles. Be on the alert for them, and remove them whenever possible for the safety of other motorists.



When driving on sand, it's a good idea to deflate your tire pressure to about 10-14 pounds and to maintain a slow but steady speed.

.....

miliar object, such as a football. If you see a rock that looks as big as a basketball, avoid it. Put your wheels on ledges of rocks, rather than straddling them. Approach bumps at a 45-degree angle for better clearance.

In mountain country, landslides and falling rocks are a possibility. If you're forced to leave the road to get around a boulder, fallen tree, or other obstacle, choose the uphill side for your detour when you can. Cranking out of a sand trap is harder from the low side of the road.

Back-road etiquette. If you meet another car on a trail too narrow for passing, the usual routine is to talk it over with the other driver, and for the one nearest a turnout to back up. Where passing is possible, look back to make sure the other fellow hasn't bogged down while making room for you. If he has, stop to help him out.

Most important, be prepared for any surprise around that next blind curve—an oncoming car, wild or domestic animals, a washout, or you name it.

Fording a stream requires careful scouting. Most important, know how high off the ground your crankcase vents, exhaust pipes, and other engine openings are. Avoid water that's deeper, and don't race the engine—the speeding fan may wet out the ignition.

When a road runs through a stream of normal height, you're probably safe.

Clear, fast-flowing water is also an indication of a firm bottom. A slow-moving, turgid stream is dangerous. If in doubt, wade through and poke the bottom with a stick.

If terrain looks unusually bad, unload the car. Be especially careful when ground looks muddy-soft. If your shoes disappear, don't drive on. Or if you must proceed, lay down a path of rocks and branches.

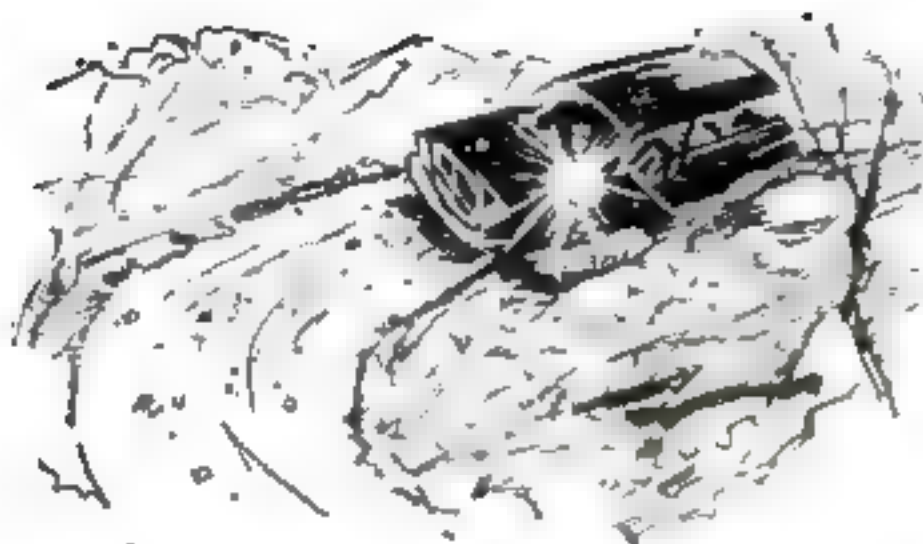
Driving on sandy beaches requires great caution. Summer heat may cause the water level of a lake to drop. Then the hot sun may dry a false crust that looks solid but won't support the weight of a car. A good rule: Stay at least 75 feet from the water.

Ocean beaches offer another threat. Get stuck too near the water and your car may be in for a salt bath when the tide rises.

Getting out of trouble. What if, in spite of all your caution, your car gets stuck? The first step is to get out and look things over.

If you have a traction problem, don't spin your wheels. You'll just dig in deeper. Whether you're stuck in sand, mud, or snow, jack up the car and make a path of branches or rocks under the rear wheels. If a board isn't handy, use your spare wheel as a platform for the jack.

If you're hung up on a rock under the center of your car's undercarriage, it may be necessary to jack up at least two



A side or rear-view mirror makes a good SOS signal. Aim it at distant traffic, planes, or simply in the direction of a nearby town.



If you take a fork in the road, mark your path with rocks shaped in the form of an arrow so you'll find your way when backtracking.

wheels and place rocks or boards under them for elevation. Then remove the jack and back off slowly.

When a front-end A-frame is hung up, as often happens, a bumper jack may not be able to raise the body high enough for the A-frame to clear. Jack up the body anyway, to take its weight off the wheels and axle. Then prop a long branch under the front axle and lever up the front wheels high enough to kick flat stones under the tires. If nothing else is handy, slide your spare wheel under.

In a pinch, a punctured oil pan can be repaired temporarily by forcing a whittled wooden plug into the hole and pouring in that spare oil you have in the trunk. A crack in the gas tank can be sealed with ordinary soap, but if the road is wet or if you cross any streams, you may have to renew it.

How to get help. But suppose you can't drive on? Your car is hopelessly bogged down, or seriously damaged.

Smoke is a good signal in flat country. Pile up dry brush, set it on fire, and beat out the flames with a jacket. At night, let the fire burn.

If you're desperate, set fire to your spare tire; it'll smoke and burn for a long time, and may attract a passing plane. If it has an inner tube, save it for carrying water if there's a source nearby. A wheel cover is another ad-lib pail.

In the desert, stay with the car. Searchers will spot it easier than they will in-

dividual wanderers. If no shade is near, dig a hole under the car and lie there till night. Then, if you have red flares, use them.

If you must try to walk out, don't start during the heat of day, and never unless you have at least two quarts of water.

Just the opposite holds true if you walk for help in mountain country. Start early in the morning. Leave your family in the car with a warning to stay put. No use letting them wander off before help arrives.

Planning your trips. There's no need for elaborate safari preparations. But even the casual cow-path explorer will do well to heed the advice of the AAA. They make the obvious but sometimes overlooked suggestion that you fill your gas tank before taking off on backwoods roads of unpredictable length. Bear in mind, too, that a two-gallon can of gas, preferably square-shaped for easy tie-down, can help you or another stranded motorist out of a tight spot.

Check the radiator. A combination of steep grades, high temperature, and low engine speed will require maximum engine cooling. Fan belt okay? And how about your shocks and brakes, including the parking brake? A cable or tow chain is a must.

A few other items: a flashlight, canned heat, extra engine oil, and red flares. In desert country, a spare container of water

[Continued on page 214]

Can Your Tires Stand a Vacation, Too?



Hot weather, heavy loads, high speeds conspire to make life tough for your tires. Here are some tips on avoiding trouble

By Robert Gorman

TIRE failure when you're miles from nowhere is a practically fool-proof way of ruining a vacation. It upsets tempers and schedules and costs more than it should, for tire bargains magically disappear on a back-country road.

What are the best ways—short of buying a full set of new shoes—to boost your chances of a flat-free trip? Visiting several big rubber companies in Akron, I put this question to tire engineers.

Vacations are murder on tires, the engineers told me. Hot weather, heavy loads, high speeds—notorious tire killers—combine to spell trouble for tires that have been running fine for light duty

around town. A casual attitude toward tire pressures won't hurt much on short daily runs, or won't seem to, but it brings grief fast on a long run.

Pressure is the key to many tire failures. It's also one of the few things you can do anything about. Most tire men talk from both sides of the mouth here. Officially, they tell you to follow the glove-compartment instructions for your car. For most 13- to 15-inch tires, recommended cold-inflation pressure ranges from 22 to 28 pounds. It is always the same across any axle, and is usually the same for all wheels, though most station wagons take two to four pounds more in back.

Off the record, many tire engineers feel that Detroit's pressure schedules

(usually based on car weight, accessories, and three passengers) are on the low side. Softer tires do give you a softer ride. But they also ride hotter, wear faster, and handle a little harder.

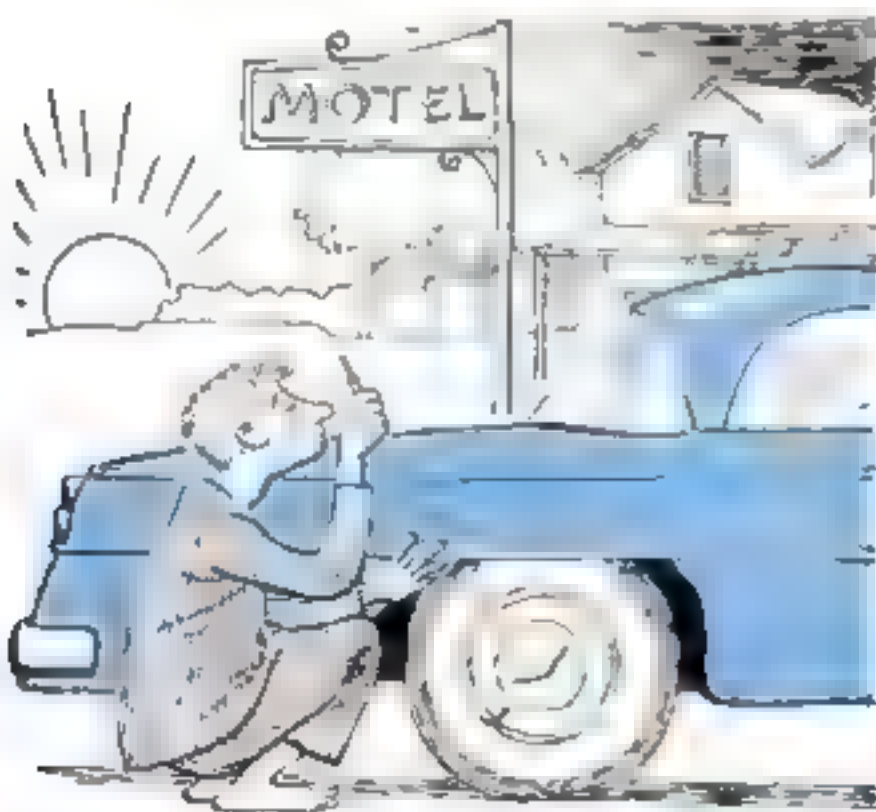
Heat is the real problem. Generated by tire flexing, it increases with both speed and load. As tire temperature rises, so does pressure.

Whether you start with high or low pressure, a tire heats up until it is radiating as much heat as it generates. This leveling off, naturally, takes place at a higher temperature on a hot pavement than on a cold one. If it goes too high (over 250 degrees, say) the tread or plies may separate and cause failure. Or the heat may weaken the tire fabric and cause it to blow.

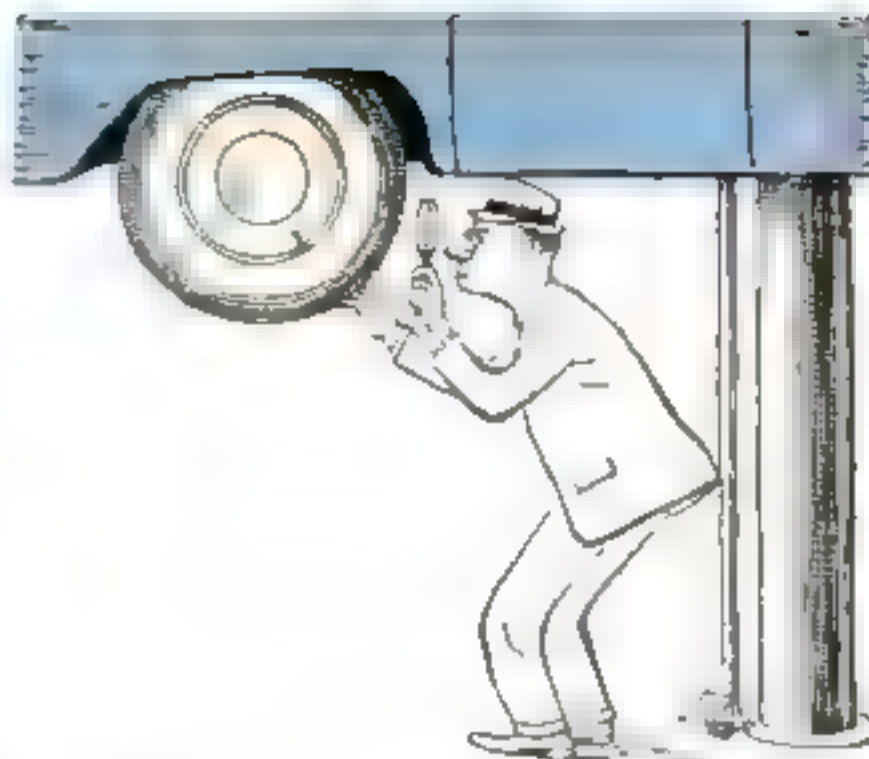
The best way to limit temperature build-up is by increasing inflation pressures—by four pounds, engineers say—for high-speed driving. You'll still get a rise, but it won't be as great. Stiffer tires flex less.

Heavy loads also increase tire flexing. And there's a good chance that your vacation driving will involve both heavy loads and high speeds. So you might expect tires will need still more air.

At this point, the Akron experts become visibly nervous. Some of them concede that rear-tire pressures can be raised by an additional two pounds



Take an early-morning reading and repeat after an hour's driving. An eight-pound or more increase spells trouble.



Before takeoff, get your car up on a lift and check for cuts, irregular shapes or bulges, and uneven wear patterns.

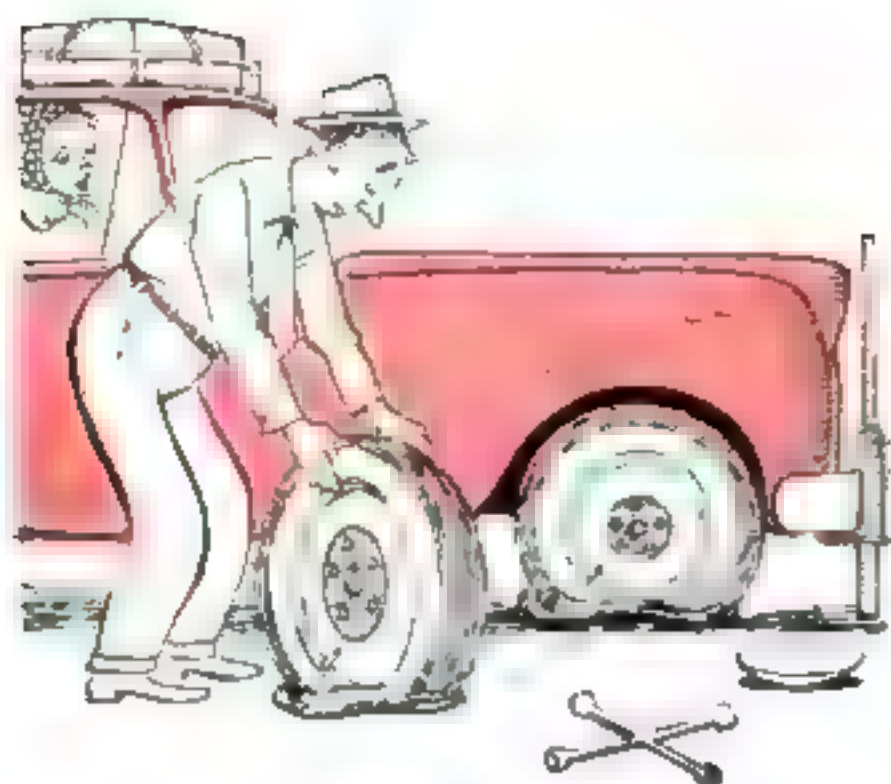
(bringing a normal 24-pounder up to 30 pounds). But others are flatly against it. The Tire and Rim Association simply backs away from the problem. A bland footnote in their maximum-load tables advises that "no increase in load is permitted" for higher inflation pressures.

One complication is that the pressures you use are likely to be rough approximations, anyway. Very few tire gauges are accurate within two pounds.

How to inflate your tires. Even if you can't be dead accurate in feeding pressure, you can be careful and consistent. Carrying your own gauge helps in two ways. It allows you to check inflation first thing in the morning before your tires warm up. It can also alert you to a nailhole or a valve or bead leak.

For even approximate accuracy, a gauge should be babied. Keep it in its own box or tube; don't drop it, or toss it in with other tools. It certainly needs replacement if readings vary when you test the same tire a few times in quick succession. (For a better check, move the car between readings so valve—and gauge—are in a different position.)

There's one exception to the rule against checking tires when they're warm. If you think you may be overloaded, take an early-morning reading and repeat after an hour's driving. An eight-pound or more increase spells trouble. Reduce speed for a while. If



Don't spare the spare. Even if it has never been used, it may have a faulty seal around the bead or valve.

you've put in less than the maximum high-speed air allowance, bring the tires up the next time they cool off. *Don't bleed excess pressure*; it will simply build up faster.

If neither step prevents a dangerous (eight-pound) pressure buildup, consider lightening—or at least redistributing—the overload. If you have room inside the car, transfer some of the weight from the trunk. If you have piled all your stuff at the rear of the station wagon to allow space for the kids, move the load forward and let the kids play behind.

Before you start. Before takeoff, get your car up on a lift and check for cuts, puncturing objects, irregular shapes or bulges, and uneven wear patterns.

Bulges are serious. They usually indicate damage to the cords or separation of rubber from the carcass. Driving a bulged tire at high speed under heavy load is asking for it.

Cuts, more common, needn't worry you unless they've penetrated to the fabric. You can tell by probing with a thin tool; if a cut extends to the fabric, the tool transmits a taut, rough feel.

Often a tire inspection will turn up a flat in the making. Tubeless tires tend to grip puncturing objects. If a nail plugs its own hole, the tire may lose air so slowly you don't notice it. But a fast

trip will enlarge the puncture, so pull the nail and have the hole patched. Look also for embedded stones, wire, or glass. Pick 'em out, and probe the cuts.

Don't spare the spare. Even if it has never been used, it may have a faulty seal around the bead or valve. A couple of pounds of air loss is normal for a tire that's been standing idle for many months. If the pressure has dropped six pounds or more, your spare wants a thorough inside-and-out inspection.

If there's irregular tread wear, it's a good time to have your wheels aligned and brakes adjusted. Rotate the tires, too. Rotating five tires helps to equalize wear and stretch life; even switching two tires across an axle helps some.

Cross-switching may be better than all-around rotation if, say, you have two tires that are much better and newer. If your car is heavily loaded, blowout of a rear tire is likely to be dangerous. Some tire men think you should put your better tires on the back.

Buying tires? You can get some improvement in load-handling capacity by going to nylon cords for your new tires. Because they have better impact resistance, they can stand more pressure.

If you plan to tote a heavily loaded trailer on a long trip, you might want to upgrade your rear tires still further. One way is by buying six-ply tires, which are built for heavier loads and higher pressures. Another is to move up one size (from a 7.50-by-14, say, to an 8.00-by-14). The fatter tire gives you about 100 pounds more load capacity per tire at any given pressure. In extreme cases you might want to go to six-ply tires one size up. But if you do either or both of these things, you'll have to forget about five-wheel rotations.

If you do buy new tires, allow a little time for break-in. A new tire stretches. If you zoom off at 70, it may chunk out bits of rubber, causing permanent vibration. So try to keep speed and load down for the first couple of hundred miles. Then have the new tires re-inflated and balanced before you start your vacation. ■ ■

Solved: one vacation problem

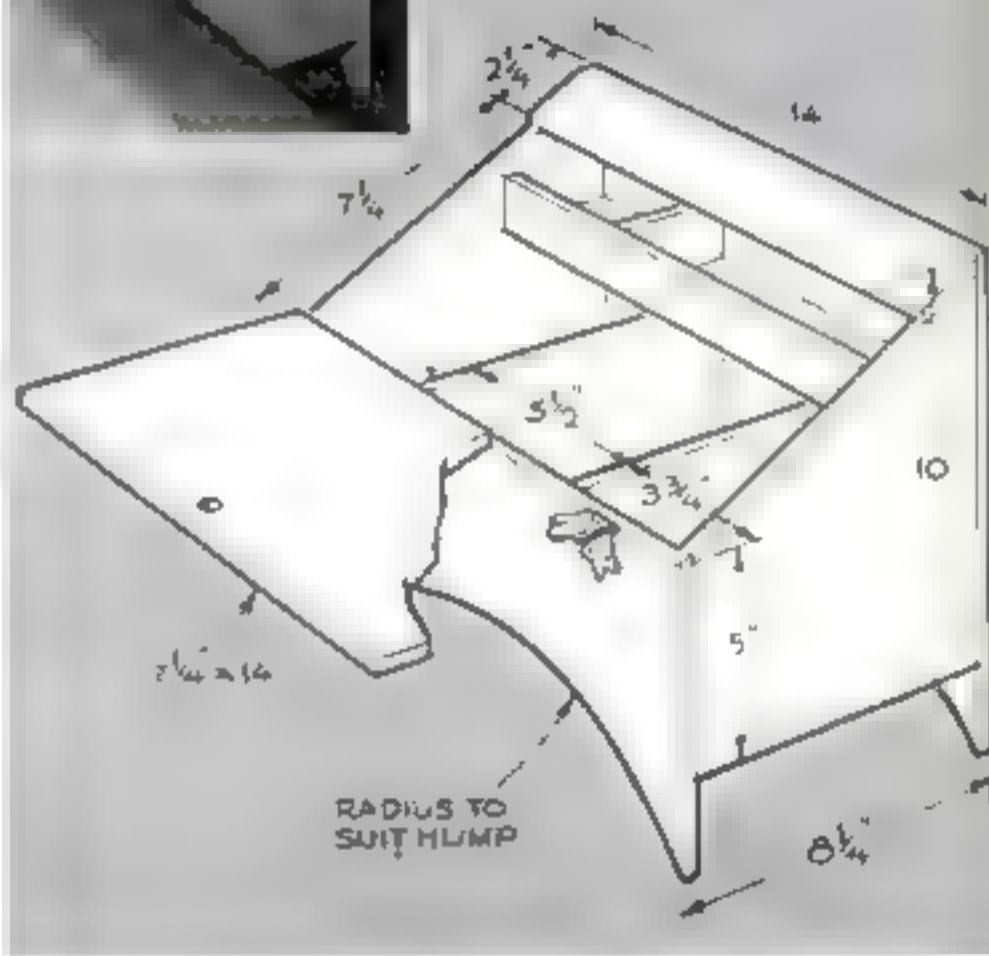
POPULAR SCIENCE **90th** YEAR SPECIAL

Camera Carrier for a Car

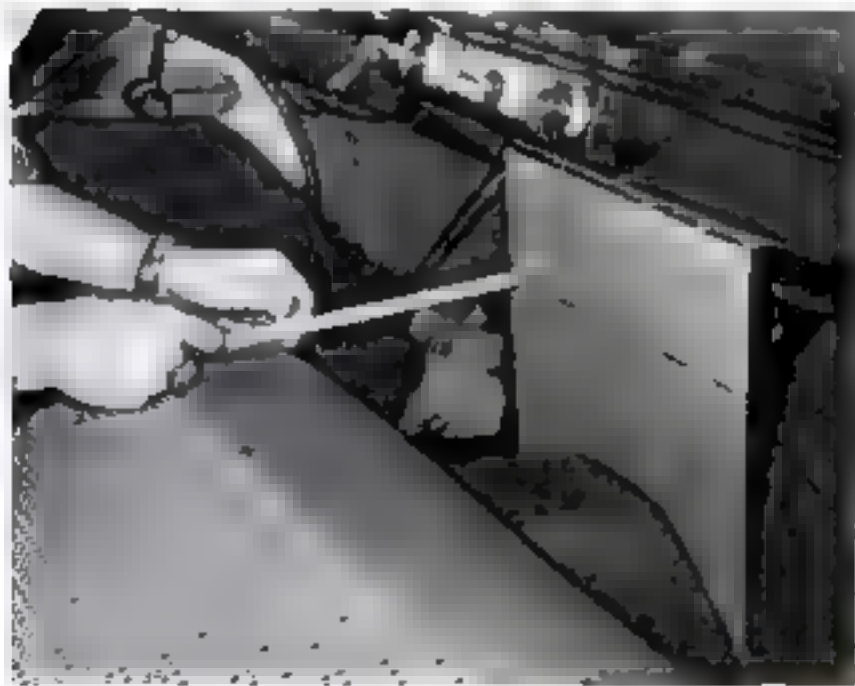
AS A roving photographer, I've always wondered where to stash my camera equipment in the car. If I store it in the trunk, it's not handy for quick, unexpected shots. There's too much of it to cram into the glove compartment (which gets too hot, anyway), and it's not safe on the seat beside me.

For less than \$2, I built this carrier out of plywood ($\frac{3}{8}$ " for the case, $\frac{1}{8}$ " for the partitions). It rides the transmission hump, leaving plenty of leg room on each side. I tailored it to my $2\frac{1}{4}$ -by- $2\frac{1}{4}$ reflex. Since I don't use a case, I lined the camera compartment with plastic foam.

My carrier also holds filters, a flash gun and three dozen bulbs, and eight or more rolls of film. The location of partitions can be altered to suit your equipment. Tacked inside the drop leaf are data guides and poop sheets, a scratch pad, and model releases. When folded down against the seat, the drop leaf makes a good jotting desk—Victor W. Kondra.



Custom-build it, adapting above dimensions to your own car. Cut cardboard template to conform to hump, set it against dash (as at left) and measure distance to seat set in driving position. Use a template to lay out the stock.





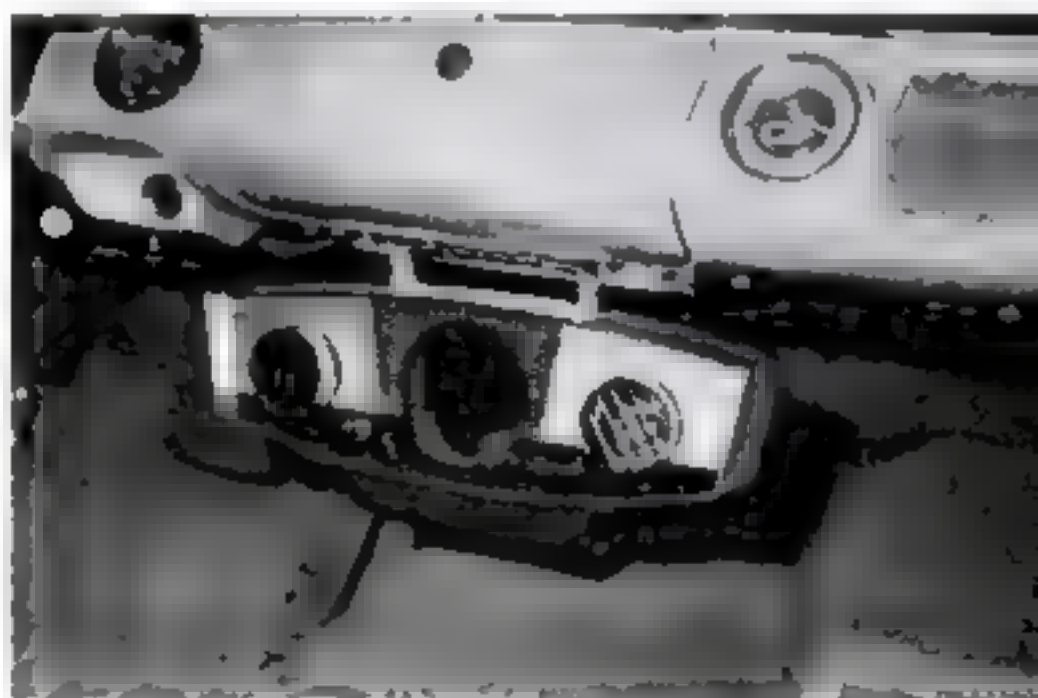
Folding aluminum trailer rides 48 inches high on road. Push a button when you park, and battery-operated motor lifts roof to make 6½-foot headroom and raises ends on hinges. Then you unfold the sides and latch them. Trailer measures 7 by 16 feet, sleeps four, contains kitchen, living room, and dinette.

It costs \$1,695 (bunks for two more adults extra). Rohite, Inc., Grantsburg, Wis.

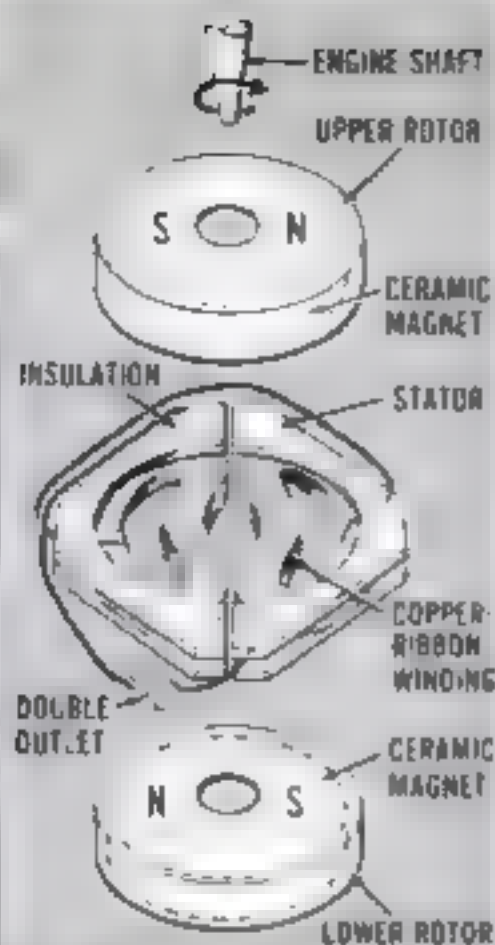
What's new



Three-burner stove in heavy-gauge aluminum case weighs one third less than steel camp stove of same size. With lid dropped, you can store or carry it like a suitcase. Fuel tank holds enough unleaded gasoline for several hours, has built-in air pump. Burners can be adjusted, and baffles at ends protect flame from wind. Price, \$34.95; similar stove with two burners, \$24.95. Coleman Co., Wichita, Kan.



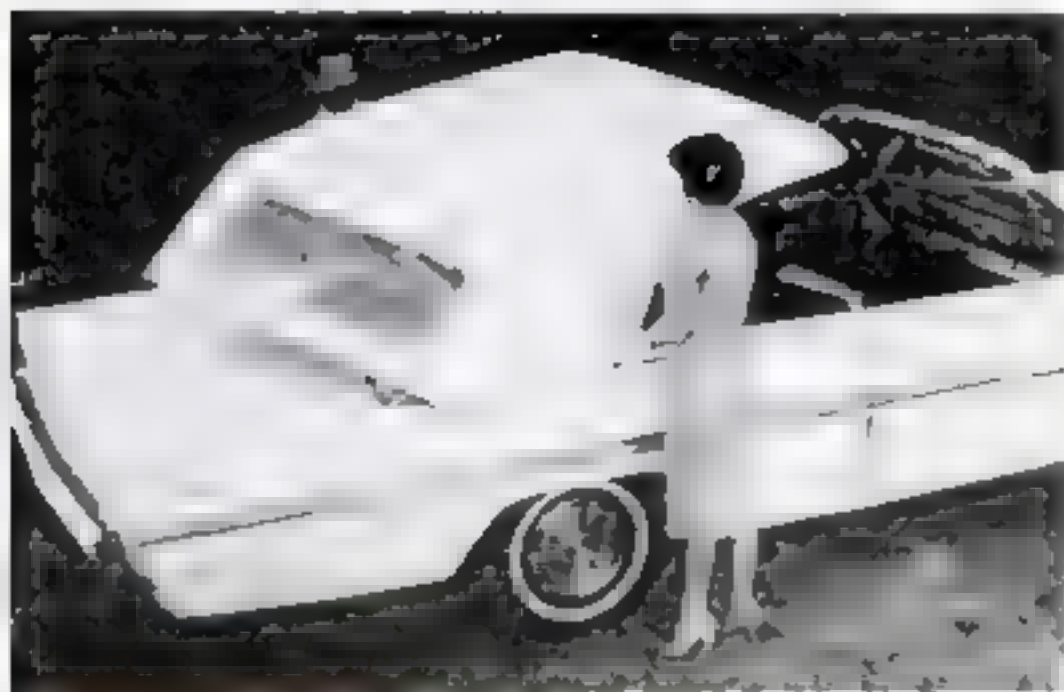
Under-dash car cooler is said to change air in car twice each minute. Stale air is drawn into radio-size case, compressed, and returned to car through two vents, cleansed, freshened, and cooled. Fan running on 12-volt car battery draws it over water trough to which you can add refreshant. Two screws hold Kar Kool in place. \$39.95. Dualair Corp., Niagara Industrial Park, North Tonawanda, N. Y.



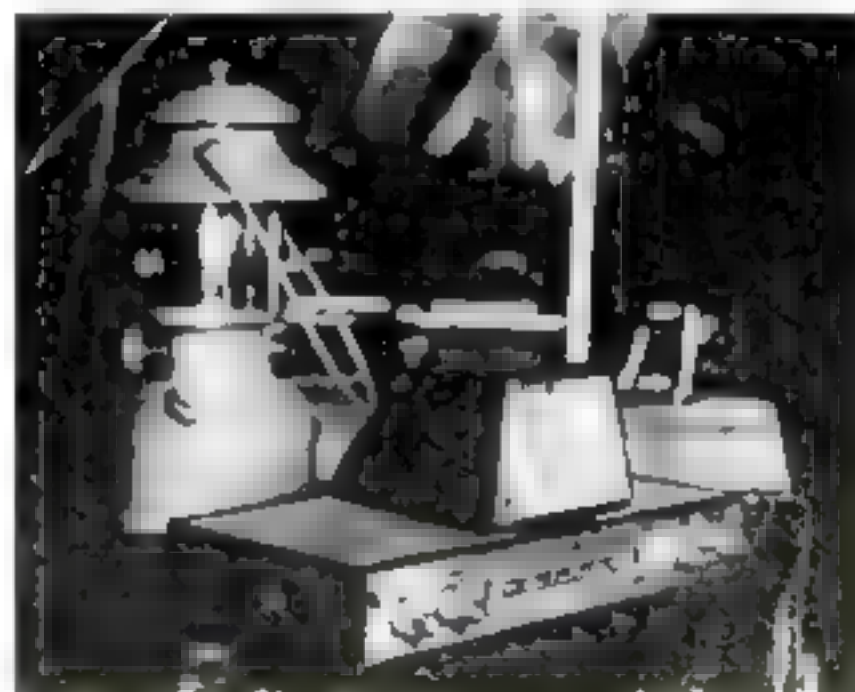
Portable generator produces 1,500 watts of 115-volt AC wherever you want it away from power lines. It works on ceramic permanent magnets in double rotor spun around coils in stator by a self-contained four-cycle Briggs & Stratton engine. It's small and light enough (65 pounds) to be carried in a car trunk with luggage. Mite-E-Lite sells for \$249.50. Hearth Industries, 954 Brooklyn Ave., Wellsville, N. Y.



Sliding sunshield covers full width of windshield when you're driving into sun, pushes up out of way on stainless-steel track on ceiling when not needed. Lower half of 13-by-54-inch Plexiglas visor is transparent and tinted, upper half opaque. You move it by handle at center, with friction of nylon slides adjustable by thumbscrew on each rail. \$39.95. Vista-Visor, Inc., 6560 Cass Ave., Detroit.

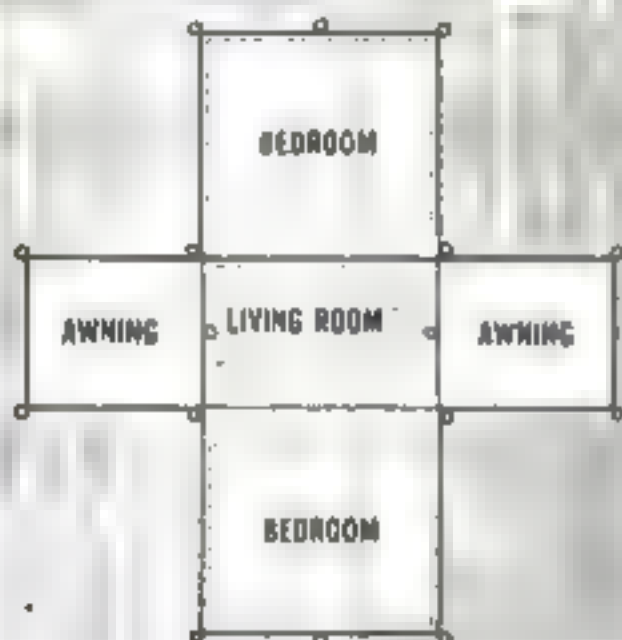


Detachable hardtop of multilayer fiber-glass fits GM convertibles. With soft top retracted, you and one helper can lift hardtop into place, fasten four clamps, and have a weatherproof rigid top strong enough to support skiing equipment, luggage on rack, or light boat. Chevrolet, Pontiac, Olds 88, Buick, \$395; Cadillac, Olds 98, Buick Electra, \$435. Le Mans, Inc., Box 11073, San Diego, Calif.



Portable clock-radio is six-transistor set powered by D-cell batteries. It provides both short-wave and standard broadcast reception. As with home clock-radios, you can set a switch to turn the radio off at a predetermined hour and—later—to awaken you to music. Cabinet has outlet for ear-phone and extension speaker. With 40-inch telescoping antenna, \$74.95. Channel Master Corp., Ellenville, N. Y.

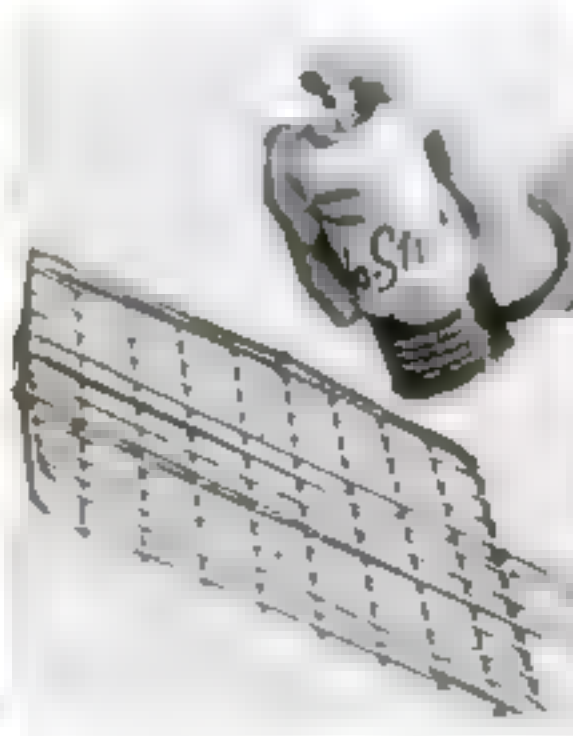
What else is new



Three-room tent encloses 7 5/8-by-19-foot floor space, with curtains that separate two 7-by-7 5/8-foot bedrooms from central living room. Center height at jointed aluminum ridgepole is 7 1/2 feet; nylon-screened end walls are 3 1/2 feet high. Awnings protect zippered screen door and rear screen window. Tent, of water-resistant drill, has sewn-in floor. With poles, stakes, guy ropes, \$185. H. Wenzel Tent & Duck Co., 2200 S. Hanley Rd., St. Louis, Mo.



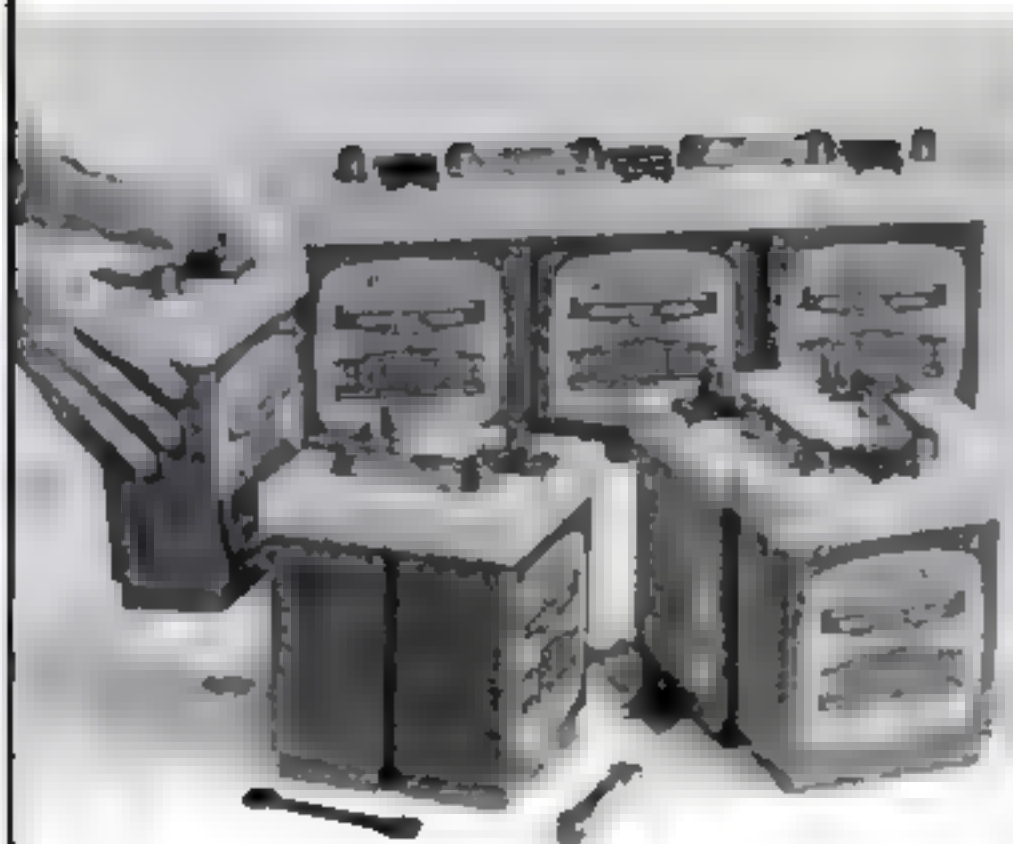
Reserve gas can has three springs on back that snap inside rim of spare tire of most small foreign cars. It holds two gallons of fuel, has leakproof cap, and pours without funnel through special spout. Junior Gas Can sells for \$10.80. Midwest Imports, Box 988, Chicago 90.



Stickproof spray keeps food from adhering to barbecue grill, oven walls, waffle irons. It dries instantly when applied, is nonflammable, non-toxic, and leaves no grease for you to clean up. No-Stick comes in two sizes for \$1.29 and \$1.98. Devcon Corp., Danvers, Mass.



Six-cell flashlight has 4 1/2-inch reflector and lens that throw beam 500 yards. Case, molded of Marlex plastic, is waterproof and rustproof, making Dynalite useful for skin diving as well as in auto and home. Price, \$9.95. Dog Supply House, Inc., Bainbridge, Ohio.



Replaceable-cell battery is made up of separate plastic cells. You can assemble three two- or four-volt cells for a 6- or 12-volt car battery, or other numbers for special use. If one fails before expiration of 40-month guarantee, you replace it at prorated cost instead of buying entire new battery. Six volts, with connecting plates, \$29.95; 12 volts, \$38.95. Autocel Co., 2602 Knobloch St., Houston, Tex.



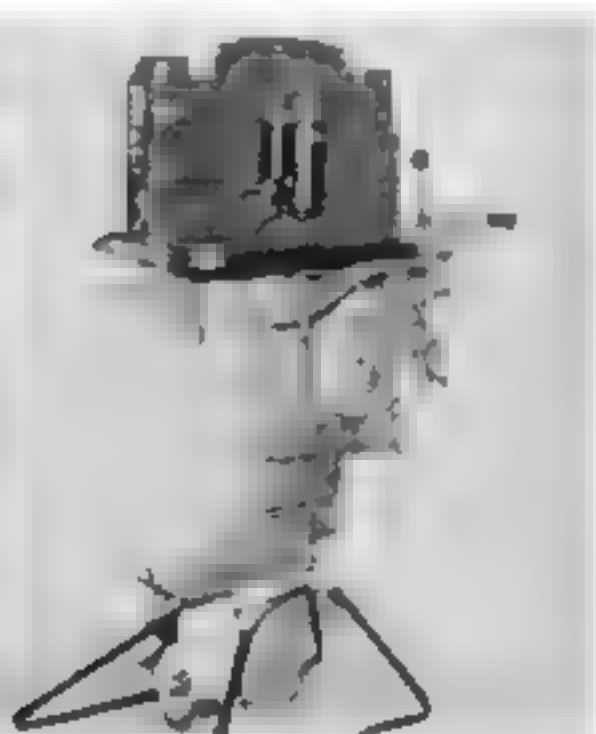
Motor-driven fishing reel takes effort out of landing big deep-sea catches. You press button to retrieve line, release it to stop without affecting drag or free-spool operation. Several reels can be used off one 12- or 24-volt boat battery, each drawing five amps and developing three hp. at 5,600 r.p.m. Electro Reel prices run from \$98.50 to \$175. Entrepreneur, Ltd., 927 15th St. N.W., Washington, D. C.



Draft-free ventilator fits front-window channel of most imported cars and domestic compacts. Roll up window and lock door, and you let air in but keep thieves out when you are parked. K-L Breezer costs \$4.75 to \$5.75 per set. Elton M. Eldredge, 18230 Grand River, Detroit.



Folding camp stove is small enough to carry in your coat pocket. Brass burner holds enough fuel for 1½ hours of outdoor cooking, or can be taken out of case and used as shop torch. Taykit pocket stove sells for \$12.95. Progressive Merchandizing, 35 E. Wacker Dr., Chicago.



Diesel outboard is 15-hp., 2-stroke, 3-cylinder in-line motor for heavy loads. First of its kind, it uses glow plugs instead of spark plugs, burns half as much fuel as same size gasoline motor. \$1,200-\$1,500. McCulloch-Scott Div., 2700 Winter St. N.E., Minneapolis, Minn.



This pickup-truck camper, made by Coons Custom Coach of Pomona, Calif., retails for \$1,095.

Now You Can Carry Your Camp on Wheels

By Don Werner

SUPPOSE you want to go on a motor vacation with your family and enjoy all the comforts of home, *without*:

- Hauling a trailer
- Stopping at motels
- Eating in restaurants
- Staying on asphalt-smooth roads
- Encountering parking restrictions at camp grounds.

You can. You can do it by carrying

your home comforts with you—piggyback. You can do it with the hottest, newest thing in campers, the slip-on coach. And what's a slip-on coach? Well, it's like a pair of rubbers for your feet in wet weather. Or maybe more like a pair of beach clogs that you shove your feet into.

Some slip-ons can convert a sedan or station wagon into a vacation home. Others attach to a light pickup truck. These generally supply more living space.



And here's one on a light sedan. Price: \$795.

The slip-on, perambulating vacation coach provides you with home comforts—and saves you money in surprising ways

But take your choice—you name it, you can have it

If you don't cotton to a slip-on, you have an alternative. That's one of the little buses manufactured by Chevrolet, Ford, and Volkswagen. They, too, can be homes-on-wheels

You think that's a pretty exciting look at the new camping outfits? That's nothing! Listen

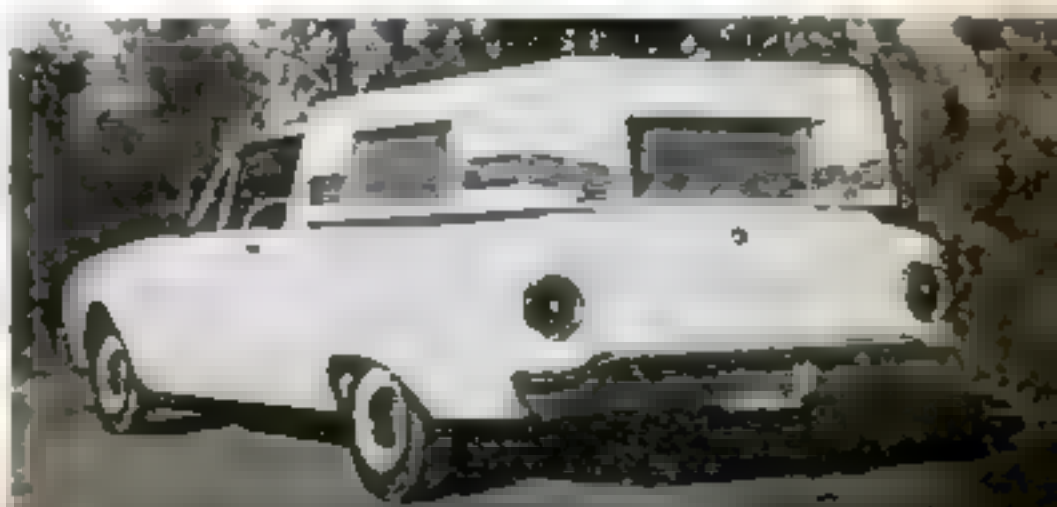
- You can roll at 60 miles an hour on the highway. (Try that with a big trailer!)
- With a good-size slip-on (or little bus) your frau can prepare meals while you're under way. In most states you

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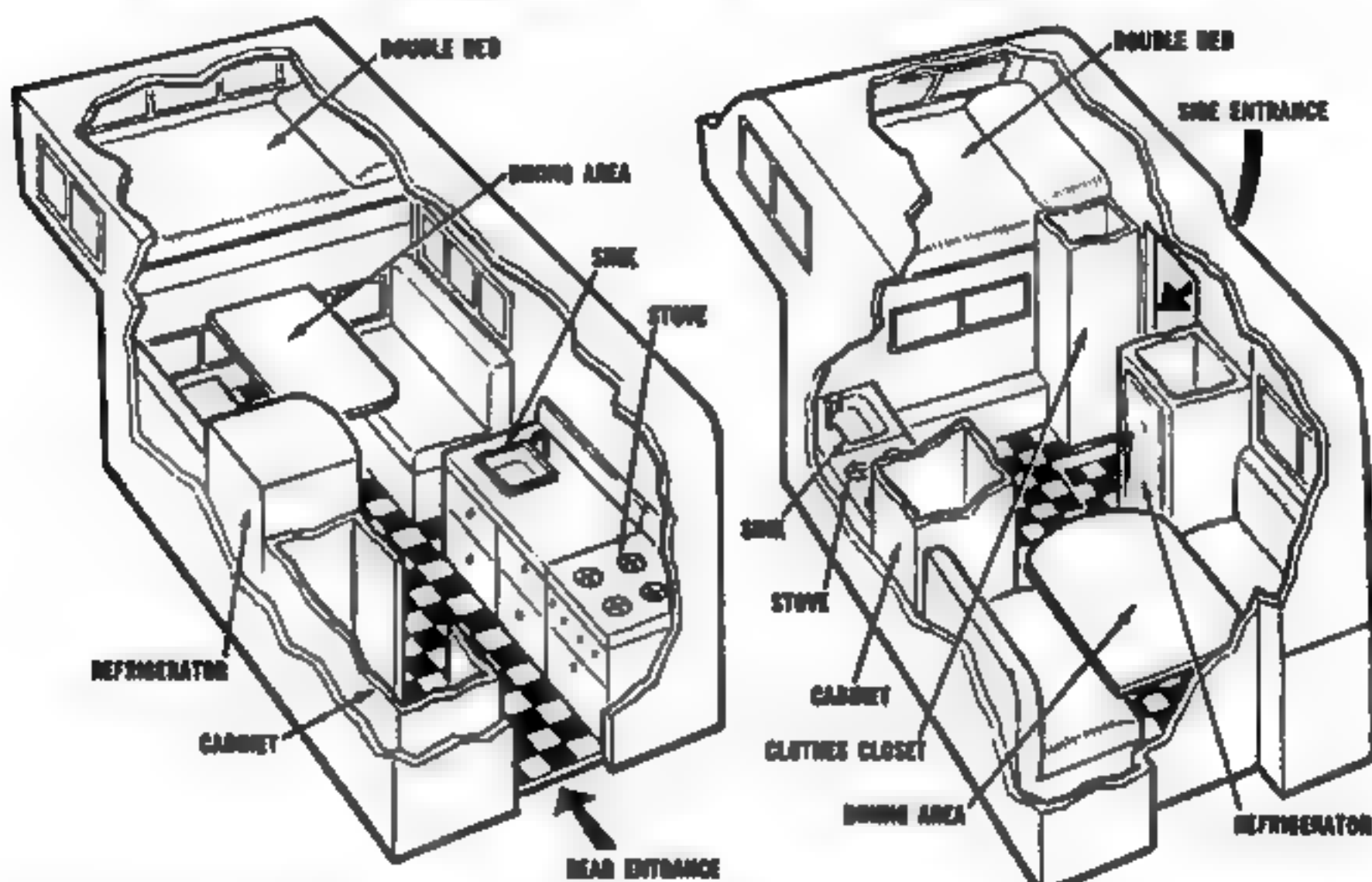


Same sedan, the camper is opened up with fly screens in place. Camper has two stove, sink with running water, cabinet, table, two beds. Floor swivels up for access to rear trunk. Manufacturer is Car-Camp of Upland, Cal.

Louvered-window austerity camper for compact car pickup must be on little flyover. Manufacturer: Haulman Co., Fresno. Price: \$225



Two standard variations: rear and side entrances



Rear-entry camper (above) has heavy fixtures at back. Weight balance and vehicle handling are impaired. Access to over-cab bed is inconvenient, and ventilation is poor.

er. Side-door layout, a new trend, is shown (right) adapted to a side-loading compact-car pickup. Coach can be mounted directly on chassis, or door put at break in sides

can't do that with a hitch and trailer—it's against the law.

- For a few dollars you can install an intercom between your driver's seat and your perambulating home in the rear. TV and hi-fi? Why not?

- You can, if you wish, have room to spare for your fishing gear, a boat, extra fuel, water, and ice.

- You can have a toilet and shower.

- Your home is on four wheels; it maneuvers like any car. (Ever try backing up a trailer with your car?)

- You need no extra license or hitch.

- Your extra insurance can run you as little as \$30 a year.

- Toll roads and bridges charge you less than for a car-and-trailer.

- If your rig is a slip-on, you can attach and detach it by yourself in a half-hour. None of that four-men-and-a-boy

stuff. If it's a bus, you're permanently outfitted. Just gas up and go.

All this would imply that a design revolution is occurring in campers. That's right, it is.

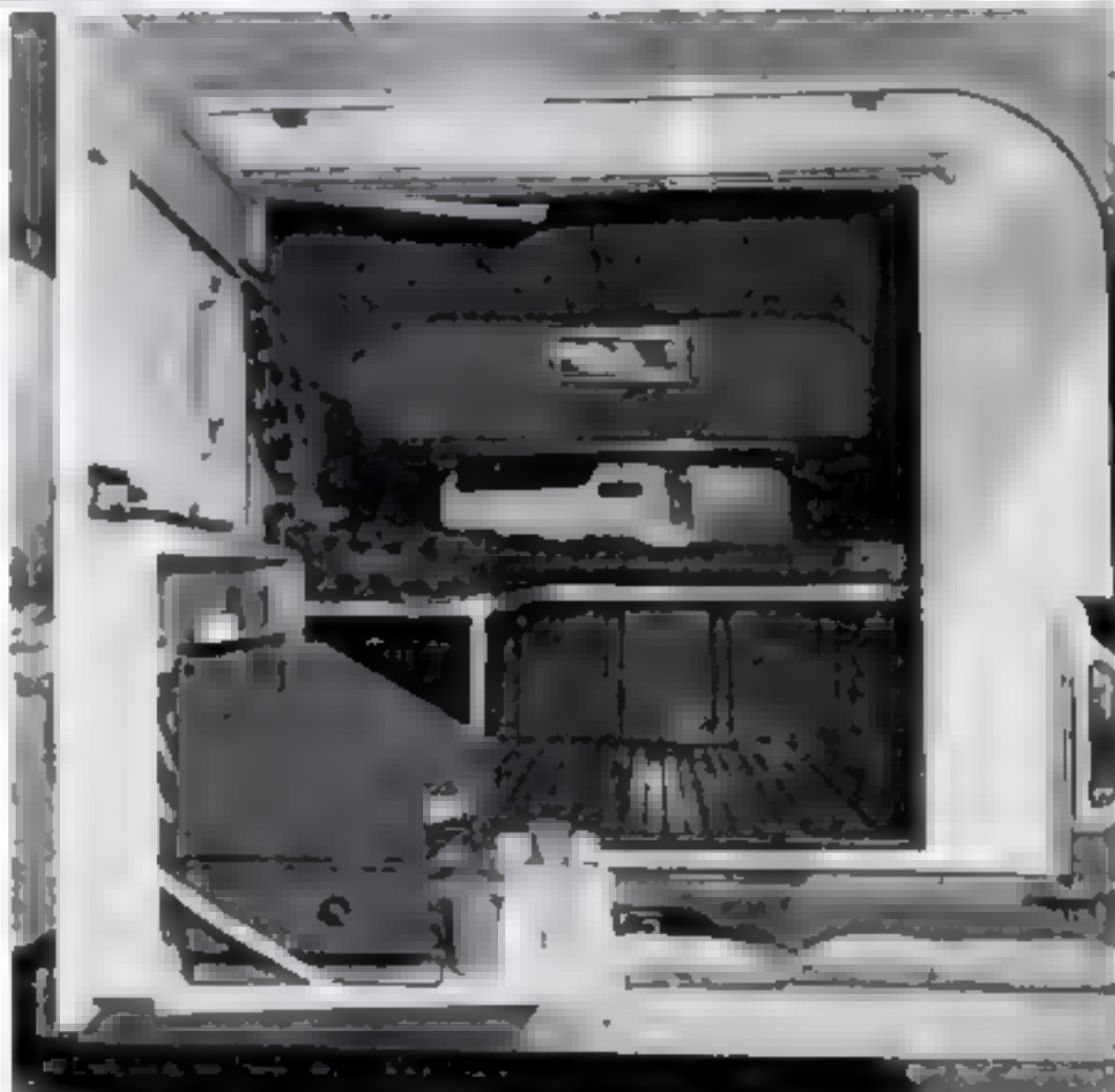
Innovations abound. Fiber-glass is being used extensively in place of dentable aluminum. Butane furnaces are widely available for frosty weather. Special compartments are provided for fishing gear and guns. Accessory boat racks—and the boats don't have to be collapsible, either—are common. Jacks for lifting camping units from car or truck, and holding them securely during storage or at the campsite, are vastly improved.

One change, relocating the rear doorway at the side, has worked a wonderful change in interior layout. The bench seats and table of the combination dining and lounge area are transferred from



Sliding canopy on nylon rollers, extending six feet to form a shelter, is novel feature of this coach. Equipment includes two bunks, swing-out stove. Manufacturer: Pullman Camper, Downey, Calif. Price is \$531

Rear view of camper (right) shows bunks being used as daytime bench seats, stove ready for use. Many newer coaches come supplied with jacks to support them while car or pickup is run underneath. Bolts secure them.



Rear end is only location for side door on standard pickup that retains box. Coach length is typical for standard pickup—10 feet, 6 inches. Kamp King is made by McNamee Coach Corp., El Monte, Calif. Price: \$1,595.



Installation of home-comfort units for camping is

the "blind" spot behind the driving compartment to the rear. Since one of the advantages of campers is that the family can ride comfortably (and legally) in the unit itself while under way, this affords an open view and ventilation from three sides.

With the door at the side, the heavier interior fixtures, such as stove, sink, water tank, and refrigerator, can be moved forward. This distributes the weight on the wheels more evenly.

Compacts, too. One fascinating offshoot of the compact car is the compact camper built on Chevy's trucklet body. At least two camper-unit manufacturers, one in the Midwest, the other in the Far West, make rigs for this tiny pickup truck.

One payoff on the 1962 camper is the ride. Time was when a day's driving in a converted pickup to a campsite off the beaten path would send a man to the doctor with a backache. Today's vehicles are sprung like baby carriages.

In sum, this sounds just dandy—but what does it cost? That depends.

The boom in camper slip-ons and buses has brought some 75 firms into

making them. This year, upwards of 60,000 new units exclusively for camping will be on the highways, secondary roads, and at fishing sites.

The cost. A survey of two dozen manufacturers by **POPULAR SCIENCE** showed that acceptable slip-on rigs ranged in price—at the factory, freight extra—from \$200 for one supplying the barest necessities to around \$1,700 for one of the flouziest models.

The buses were something else again. Fully equipped with living quarters, Chevy's Greenbrier, at a modification factory in Indiana, came to \$3,550. A Ford Falcon bus was tagged at \$3,350. The lowest-cost Volkswagen bus, living quarters extra, retailed at the New York port of entry for \$1,995; a somewhat fancier model went for \$2,275.

The slip-on rigs shown on these pages range in price from \$225 all the way up to \$1,595.

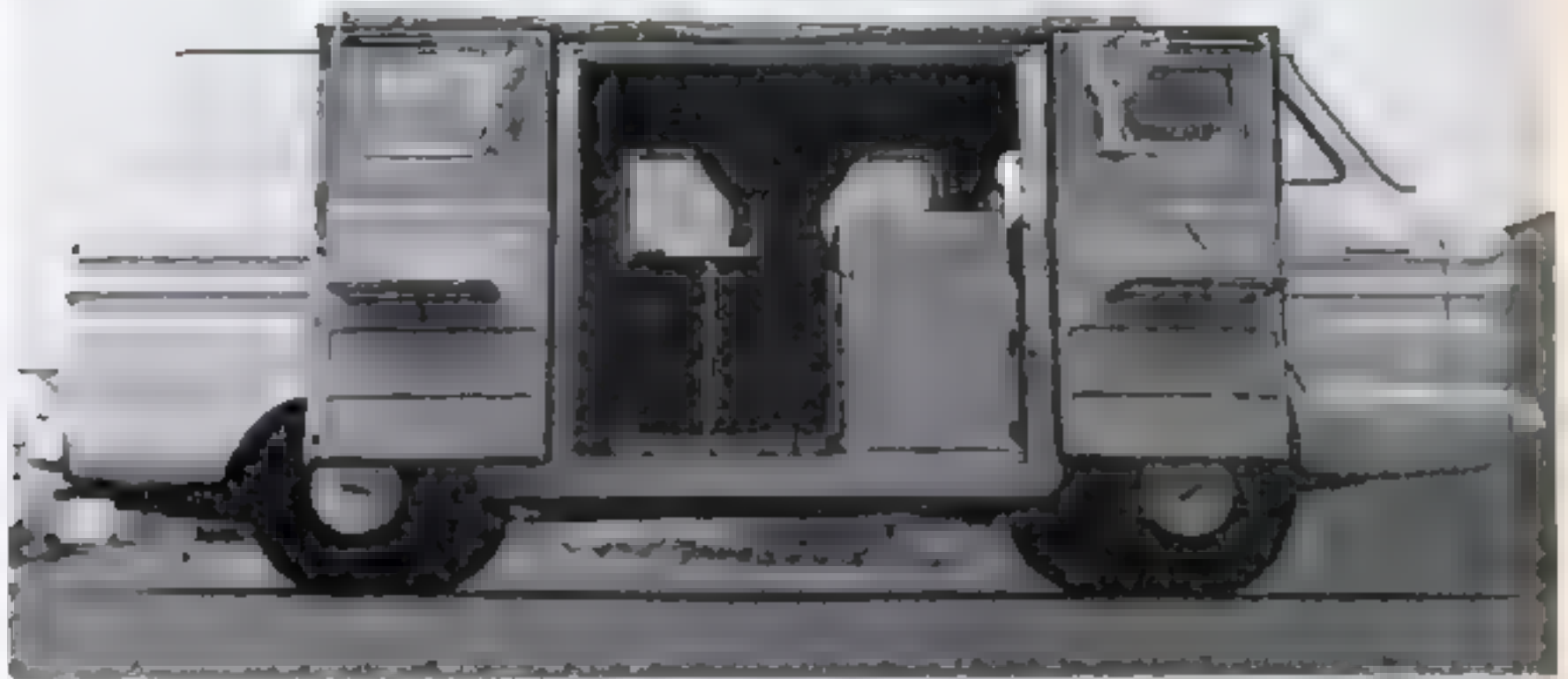
Improvements in campers year to year—indeed, month to month—are going about as far as your imagination can roam. One builder even has a design for a camper that includes a wood-burning fireplace.

Unique feature of this trucklet camper is full-width front window atop cab. Coach is equipped with gas stove, refrigerator, sink,

marine toilet (with water pump and septic tank), double bed, two berths. Manufacturer is Traville Corp., Detroit. Price, \$1,245.



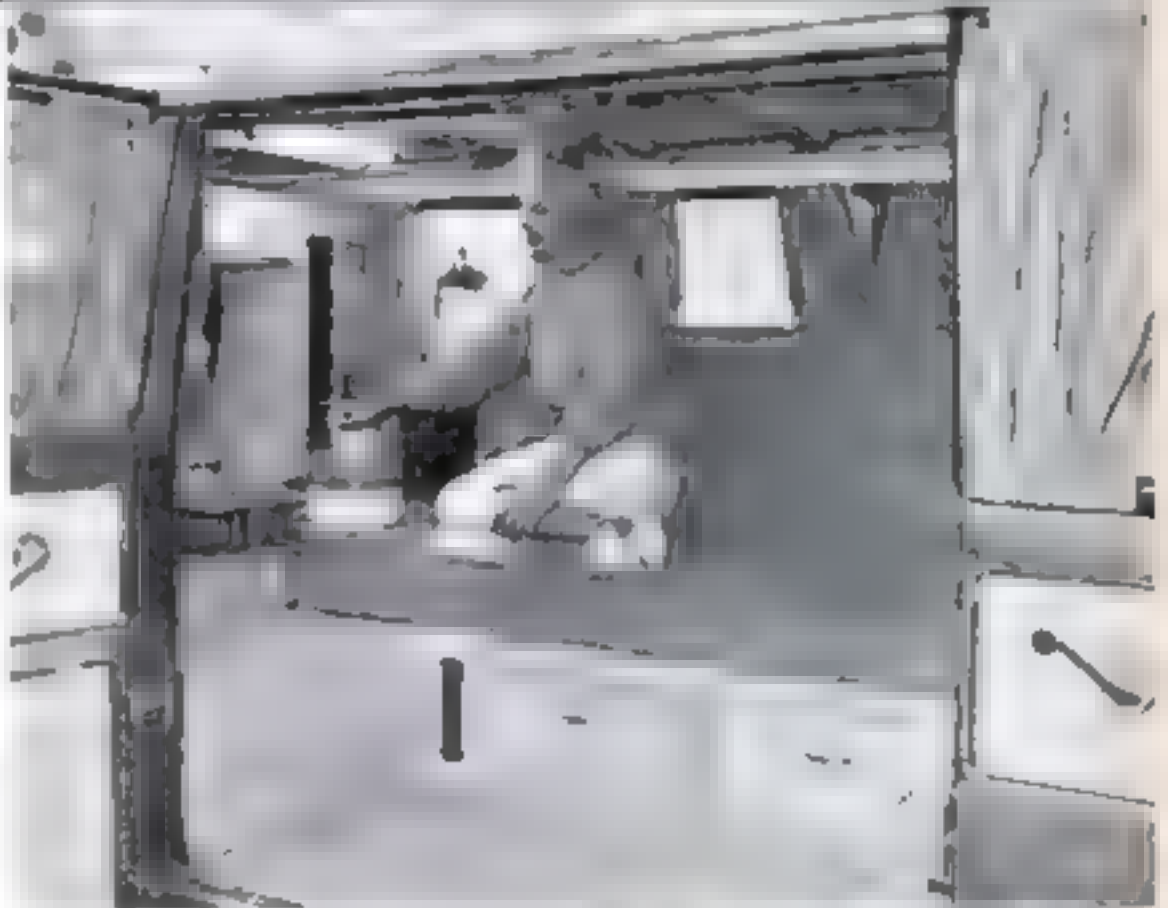
easiest in new side-entrance trucklets and minibuses

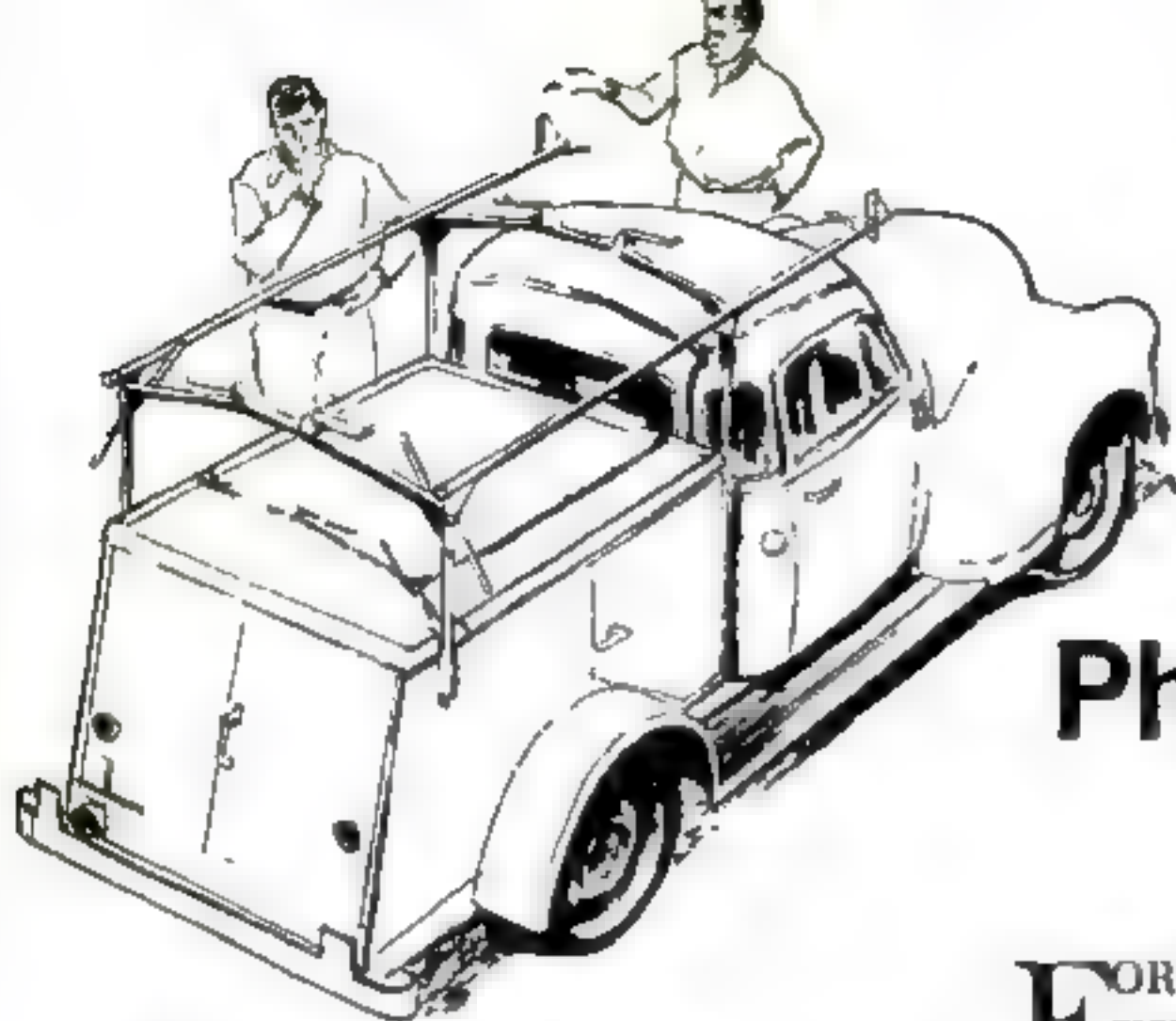


Minibus camper sleeps three; highest entrance is entrance from interior. Interior includes icebox, three burner stove, water tank, sink, table, cabinets. Manufacturer is Roll-A-Long Co., El Monte, Calif. Price: \$895.

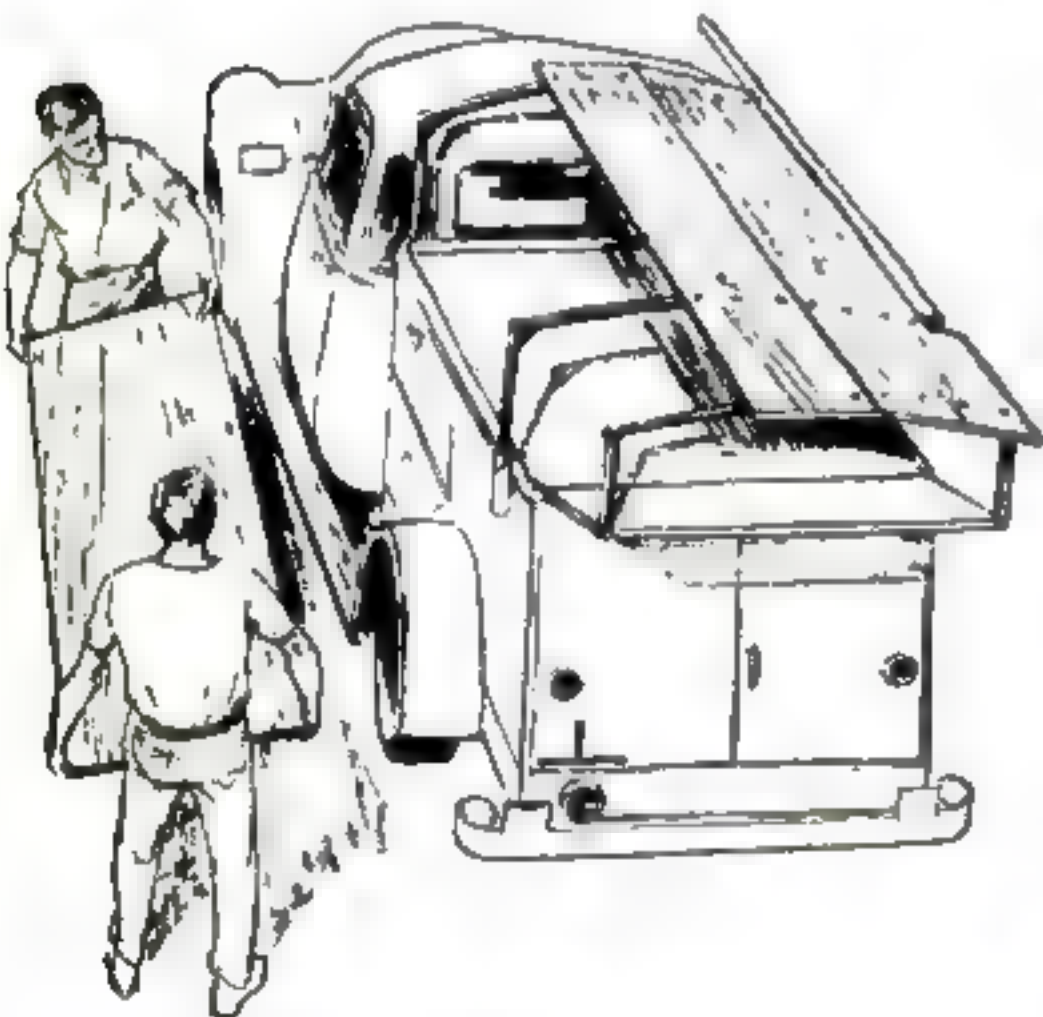
Another minibus or trucklet conversion might come as a do-it-yourself kit. Interior has cabinets, couch that becomes double bed table. Unit is sold by Chevrolet dealers at \$795.

Still another kit for conversion of a school bus creates an interior with two seats that fold into a double bed. Four additional windows are supplied. Made by Sportswagon & Campers, Highland, Calif. \$595. ■ ■





"Our telephone service truck looked like this before its conversion. To make a camper, we first stripped all the accessories from the ladder rack, leaving only the bare frame."



"A roof for the sleeper was easy—three two-by-seven half-inch exterior-plywood pieces bolted lengthwise to the ladder-rack frame. A footboard lengthened the bed."

"For easy picture taking and more sunshine, we cut a sun roof in the top of the cab and covered the edges with a refrigerator gasket. Leakproof canvas snaps over the hole."

We Built a Camper from a Phone Truck

By Roger Williams

FOR those with a yen (but not the money) for a motor camper, a friend and I have an answer. We built our own camper for \$250—including the truck we mounted it on.

Our pocket-money camper toted us 18,000 miles through 14 states, British Columbia, Mexico, and Central America.

The secret? That's in the basic vehicle we used. We bought an aging, but perfectly maintained, open-body telephone service truck for \$150. They're easy to get these days—telephone companies are changing over to more up-to-date trucks. We then spent \$100 fixing it up. It turned out to be even more practical than we imagined.

The pictures explain the conversion.

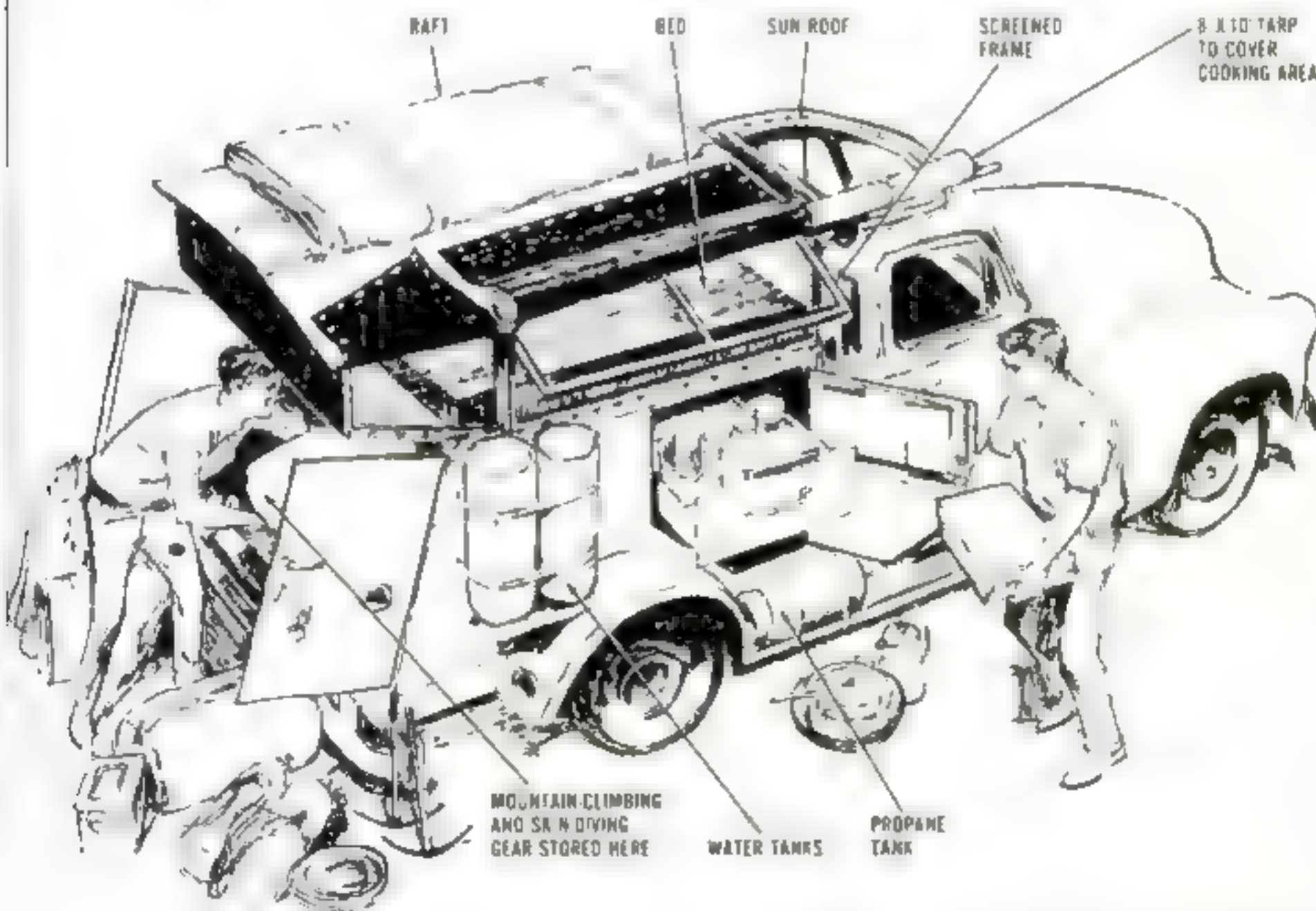


This home on wheels carried two men 18,000 miles —
for an original investment of \$250



"Here she is on the road. We carried a five-man inflatable raft lashed to the roof. On the

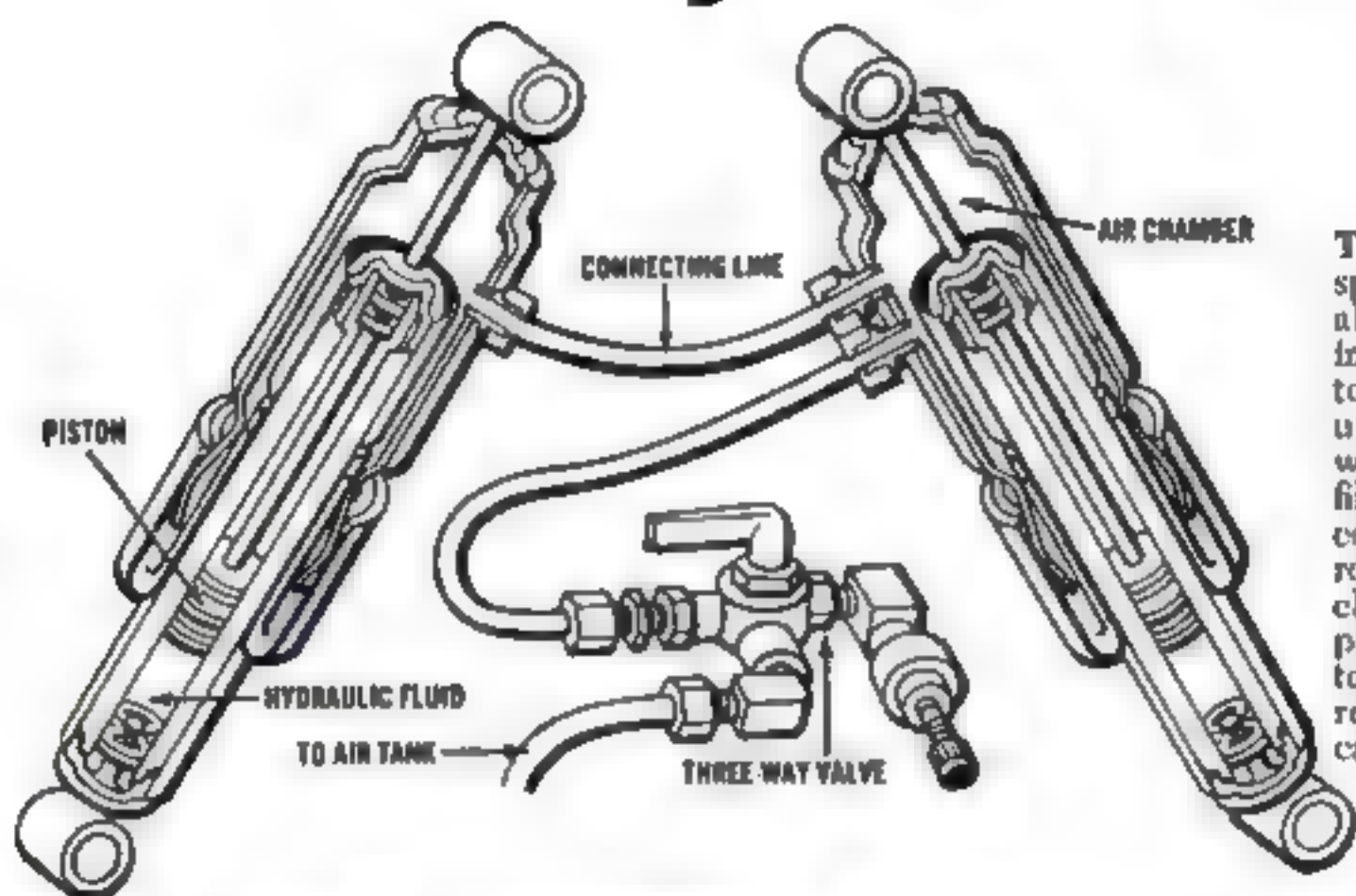
running board are two jerry cans filled with extra gas—a must on a trek like ours.



"A screened frame and long screen doors filled the area between roof and body. A snap-down canvas cover protected this in traveling. The tanks you see were for propane and water."

Vacation-trip overloads in the back of my car mean nothing to me now . . .

I Can Pump Up My Shocks Anywhere



To boost cargo capacity, special inflatable shock absorbers are installed in place of regular ones to raise car's rear end under heavy loads. They work like standard oil-filled hydraulic type except that they are surrounded by an outer air chamber. By varying air pressure inside, the pistons can be extended or retracted to keep the car level at all times.



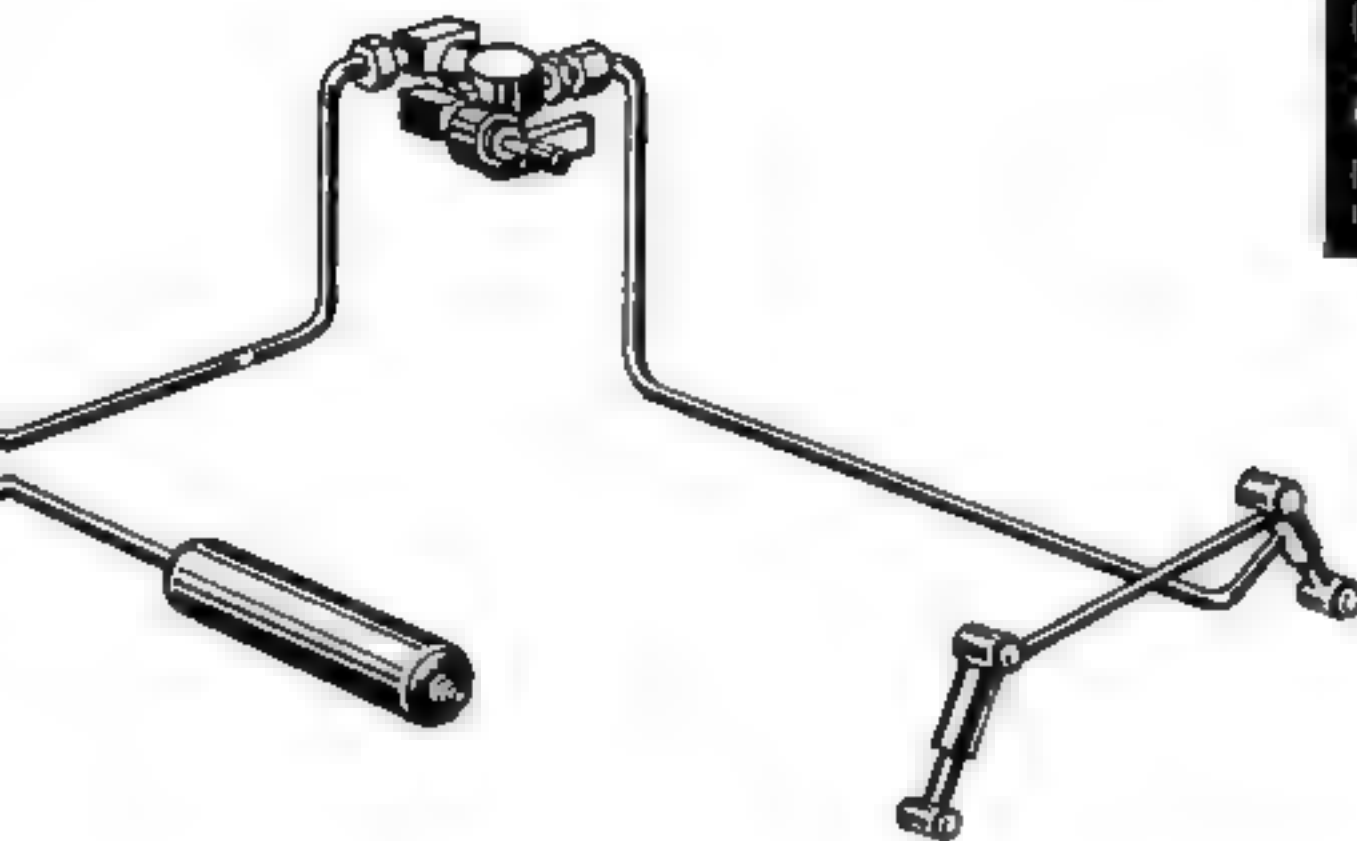
Three-way valve needs only two lines, one to shocks, other to tank. Third opening is fitted with filler stem that comes with the shocks. Bleed hole for venting shocks is at the back.

By E. F. Lindsley

OUR last camping trip was almost ruined before it began because our station wagon's springs rebelled at the load. We'd packed the car the night before and made a hasty pre-dawn getaway. The first sign of trouble was the tilt of the headlights—they were awakening still-snoozing birds in the treetops. Twenty miles later, I gave up and headed back home. The wagon was impossible to handle.

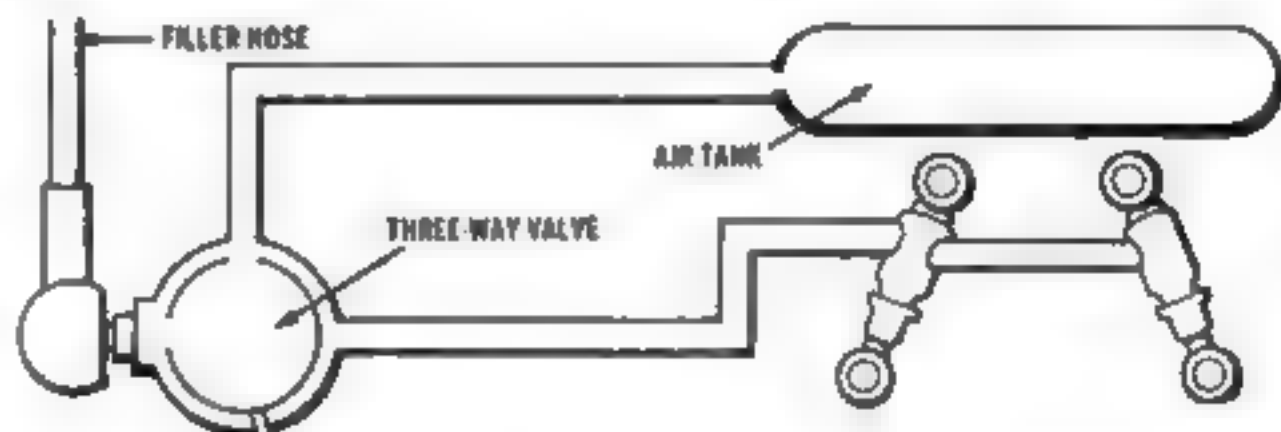
Over heated protests from wife and children, I jettisoned better than 100 pounds of "necessities" and started out

Mechanics and Handicraft SECTION

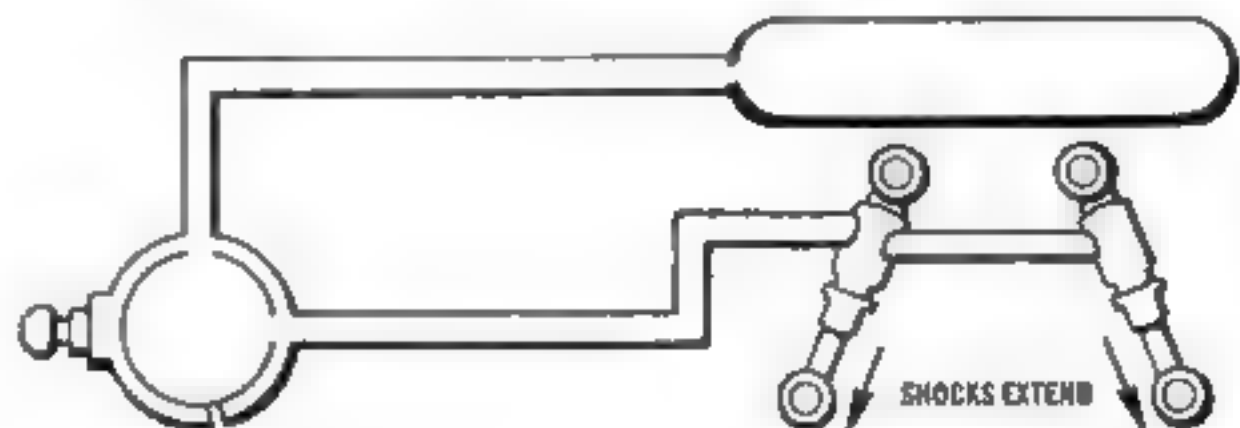


How the three-way valve raises and lowers the car under any load

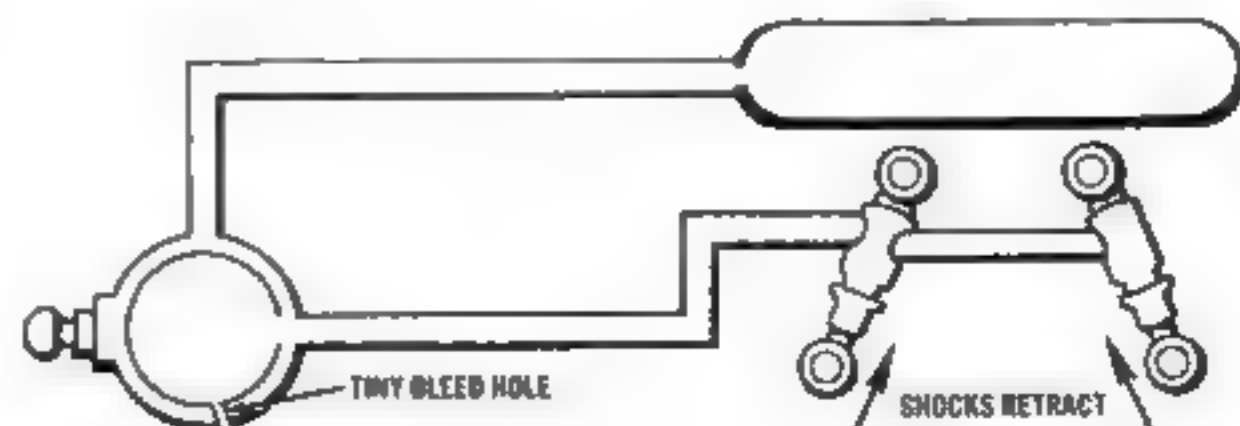
1 At start of trip, air tank is filled from a gas-station hose with valve in this position. Valve is under dashboard so all adjustments can be made without leaving the driver's seat



2 For heavy loads, the shocks are pumped up by turning the valve so it links them with the feed line from the air tank. When the car's rear end comes up level, the valve is shut off.



3 For light loads, the shocks are vented until car again rides level. Valve is turned to the tiny bleed hole drilled in its back. The air escapes slowly, making accurate control easy



CONTINUED

again. The car still wallowed, and I worried over it the whole trip.

Back home, I shopped for something to boost the wagon's carrying capacity. The manufacturer offered a fairly expensive heavy-duty spring option, but in ordinary driving we'd ride a hard saddle.

The pump-up units looked good, but had one disadvantage. If I wanted to soften them up for side trips away from camp, I'd have no air to fill them again.

Finally, an idea struck me: Why not combine pump-up shocks with an air tank to inflate them whenever I wanted? The Superlift type sold by Delco is a more or less standard hydraulic shock, but jacketed with an outer air-filled sheath that pumps up to boost a sagging rear end. A connecting hose between right and left shocks keeps both evenly balanced.

POPULAR SCIENCE

90th
YEAR SPECIAL

I checked with Delco about the tank and received their blessings, plus a stern warning not to use a spare tire for an air tank since the pressure might blow the tire apart. Somewhat red-faced at their mind reading, I looked around the surplus stores and found a long, thin oxygen tank for \$4. It had a threaded fitting that made hookup a cinch.

Locating the filler valve took some thought. I considered the back of the station wagon, but this was right where all the camping stuff was always piled. Also, with the valve in the cargo compartment, I couldn't tell from the necessary hands-and-knees position just how much air to valve into the shocks. I then moved the valve up under the dash. This was better. Now, with the car loaded, I could simply valve in enough air to raise the tail and drop the headlights to the normal position.

These ready-made boosters also brace a sagging rear

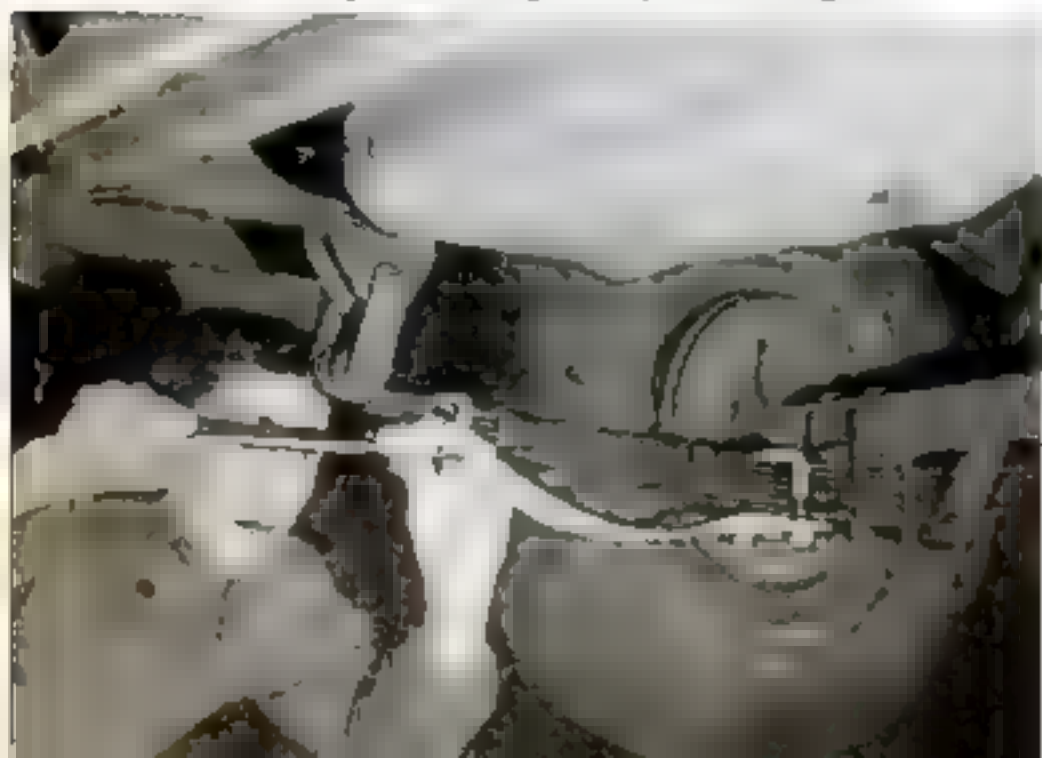
DEPENDING on your needs, there are several commercial types of overload shocks and springs that can help end dangerous bottoming and sluggish handling when you're traveling heavy. They're available at auto-supply stores in a wide range of prices.

Booster springs clamp to leaf springs to give a stiffer ride. Their action can be turned off without removing them from the car. The type shown here sells for about \$17 a pair from Imperial Mfg. Co., Philadelphia.

If you're looking for something you can put on and forget, there are hydraulic-type shock absorbers that use, in addition, a progressively wound spring to increase resistance to settling as load increases. One type is called the Columbus Level-Ride and another the Monroe Super Load-Leveler.

Pump-up shocks are available in two types, Gabriel's Load-Absorbers and the Delco Superlifts shown on the preceding pages. Both are installed in place of standard shocks and use an air cushion to give extra lift under load.

Air bags, made by the Air Lift Co., are another type of pump-up load booster, but they don't replace regular shocks. They fit right inside coil springs or can be used with accessory coils on leaf springs. Pumping them up increases the stiffness of the coils under load, but is a hands-and-knees operation at the gas station. For more convenience, they



My next problem arose when I tried to valve air out of the shocks with a light load. The valve was a four-way type used to connect gasoline saddle tanks on trucks. Try as I would to open it just enough to let out a little air, I'd wind up with a fast "swoosh" that dumped nearly all of it. The opening was too big.

I switched to a three-way valve, bought at an auto-supply store. By taking it apart and drilling a 1/16" bleed hole in the back, I found the shocks could be eased down just right. (It's important to clean off the burr after drilling or the valve will jam or leak.)

The Superlifts come with a tire-type filler valve for inflating the shocks. I attached this to one of the openings in my three-way control valve. From the other two valve openings, I ran one air line to the shocks and another to the air-supply tank. Now, by turning the valve handle, I can fill the tank through the filler fitting, then switch air from the tank into

the shocks when the car is riding heavy. When the car is empty, I vent the shocks through the tiny bleed hole in the valve.

The valve is mounted under the dash with the filler facing outward so I can reach it easily with a gas-station air hose. I sneaked the two lines down under the floor mat, through the firewall, and along the car frame to the rear. I found a handy niche for the tank up under the frame and lashed it with stainless-steel TV antenna strap.

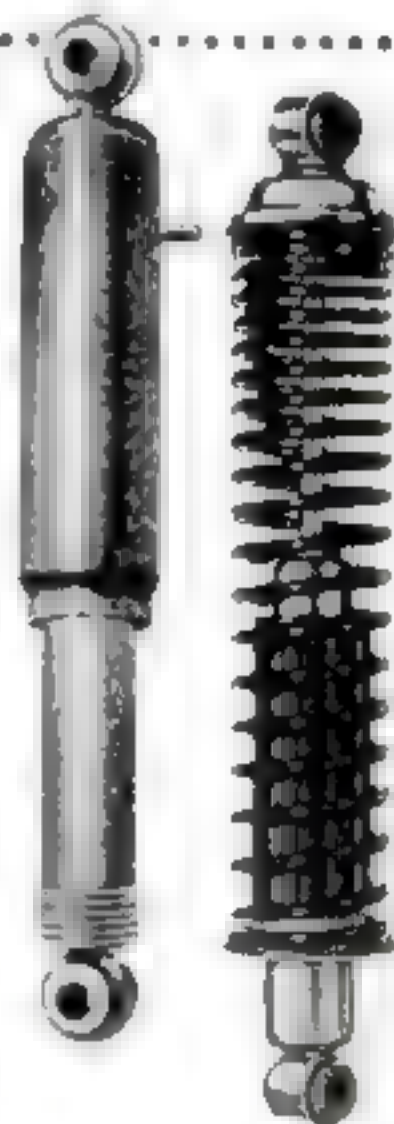
Installing the Superlifts was no problem since they bolt right in place of the original shocks. The kit, which sells for about \$50, contains support clips to keep the line between the right and left shocks off the hot tailpipe—a must.

The Superlifts are designed to operate at 10 to 14 pounds' pressure with light loads. For real burdens, as high as 65 pounds can be used. The Delco Superlifts are sold by United Motor Service, General Motors Bldg., Detroit. ■ ■

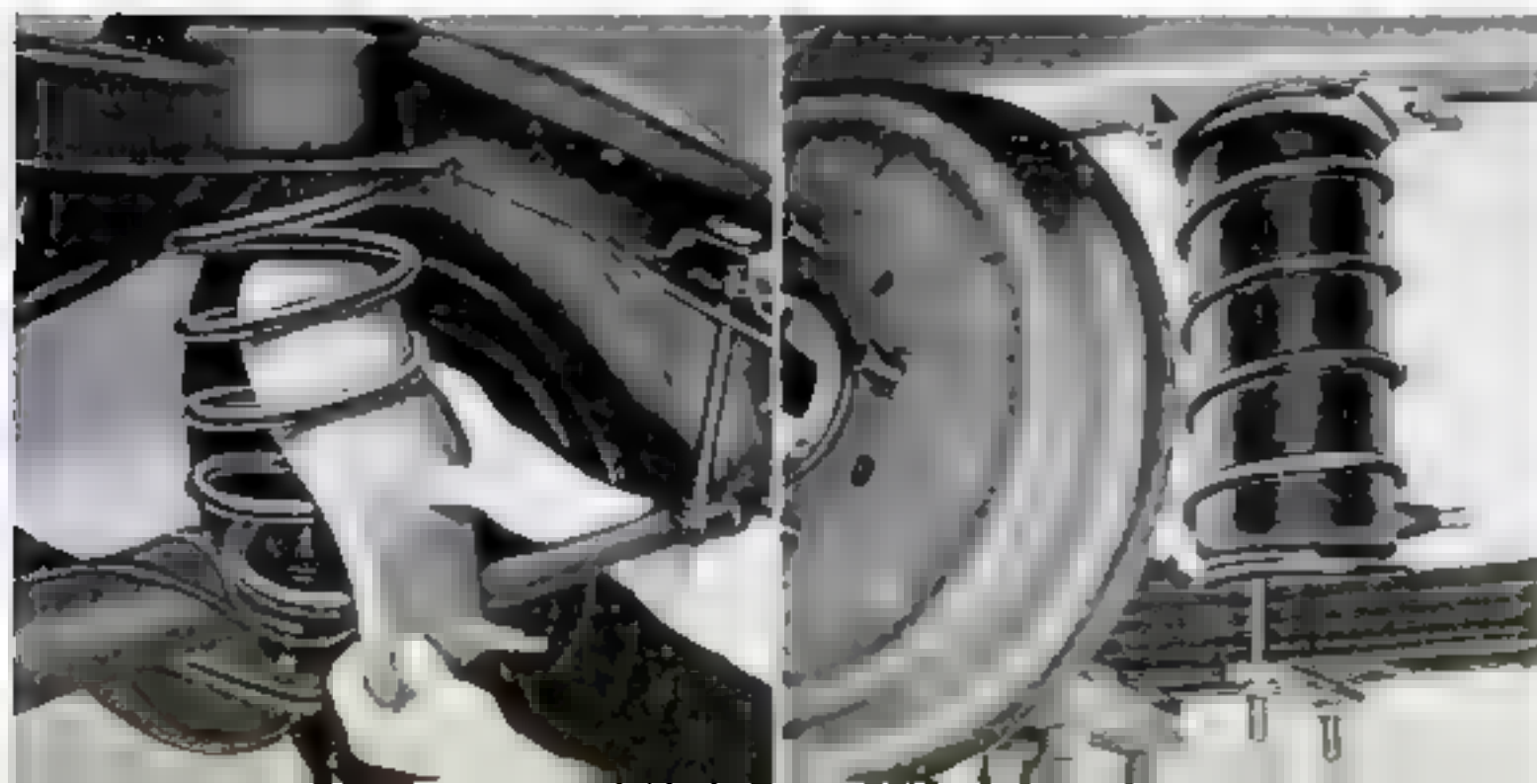
could be combined with a self-contained air supply, as shown for the pump-up shocks, so you can inflate them without getting out of the car.

You'll also find several types of helper springs. These are steel straps that clamp on the underside of regular leaf springs to beef up their backbone. Their action can be adjusted from weak to strong by cinching them tight with the car jacked up to various heights. It's an under-the-car wrench job, but price is modest—about \$17 a pair.

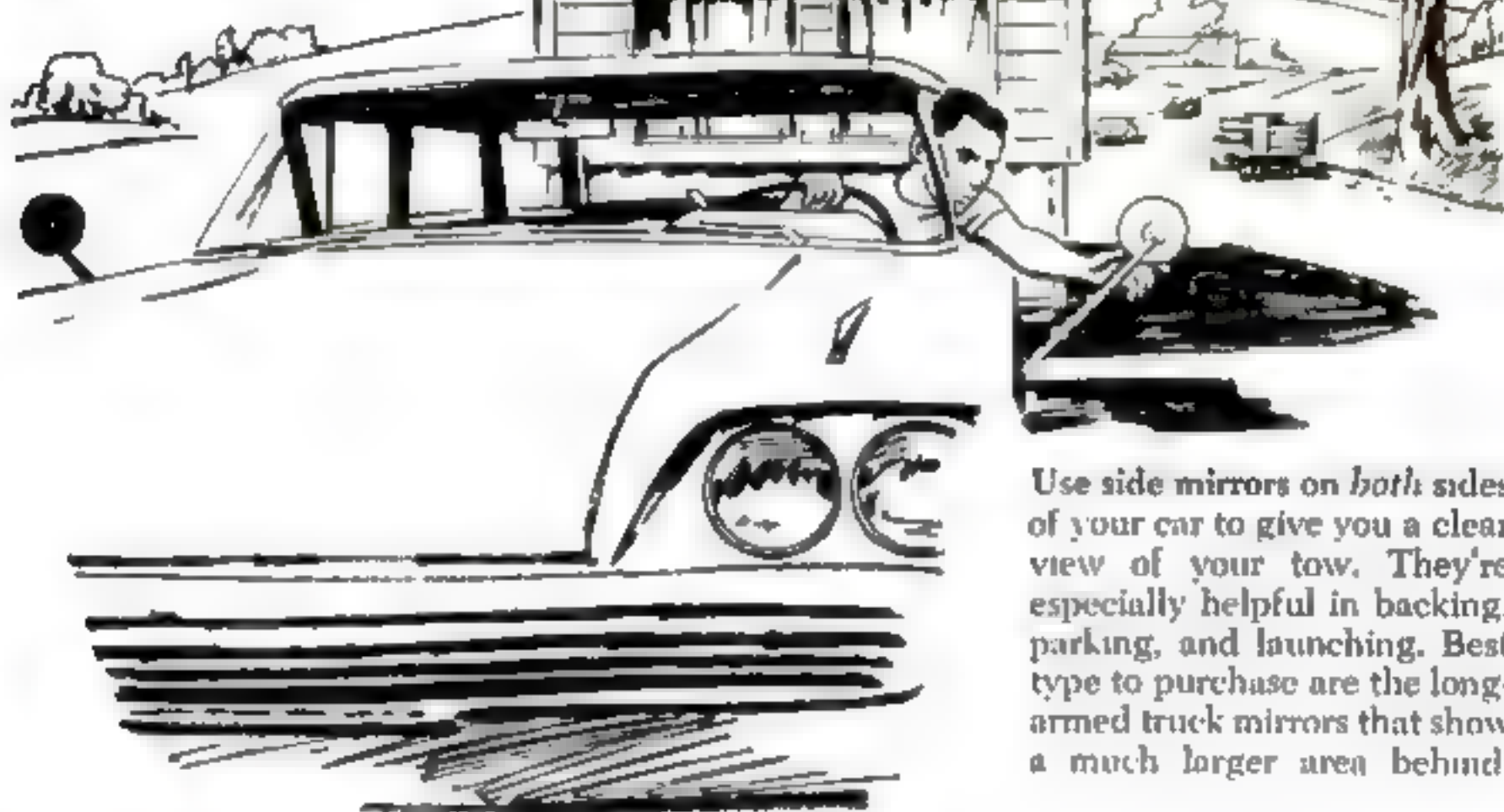
Pump-up shock at near right is Gabriel's Load-Absorber. It's similar to type shown on preceding pages and can be inflated either at a service station as needed or from an air tank carried in the car. At far right is Monroe's Super Load-Leveler. A heavy coil spring is added to a conventional hydraulic shock-absorber unit to stiffen its resistance under load. Price of the Load-Leveler is about \$44 a pair.



Air bags are rubberlike bladders that are inflated to stiffen coil springs. They go inside existing coils (far left) or can be used with accessory coils on leaf springs (near left). Air Lift bags cost about \$27 to \$35.



7 Tips on Trailer Towing



Use side mirrors on *both* sides of your car to give you a clear view of your tow. They're especially helpful in backing, parking, and launching. Best type to purchase are the long-armed truck mirrors that show a much larger area behind.



Check weight on hitch by resting the trailer's tongue on ordinary bathroom scales. To avoid overloading the car's rear end, this should not exceed 50 to 75 pounds for boat trailers, 150 to 300 pounds for house trailers.

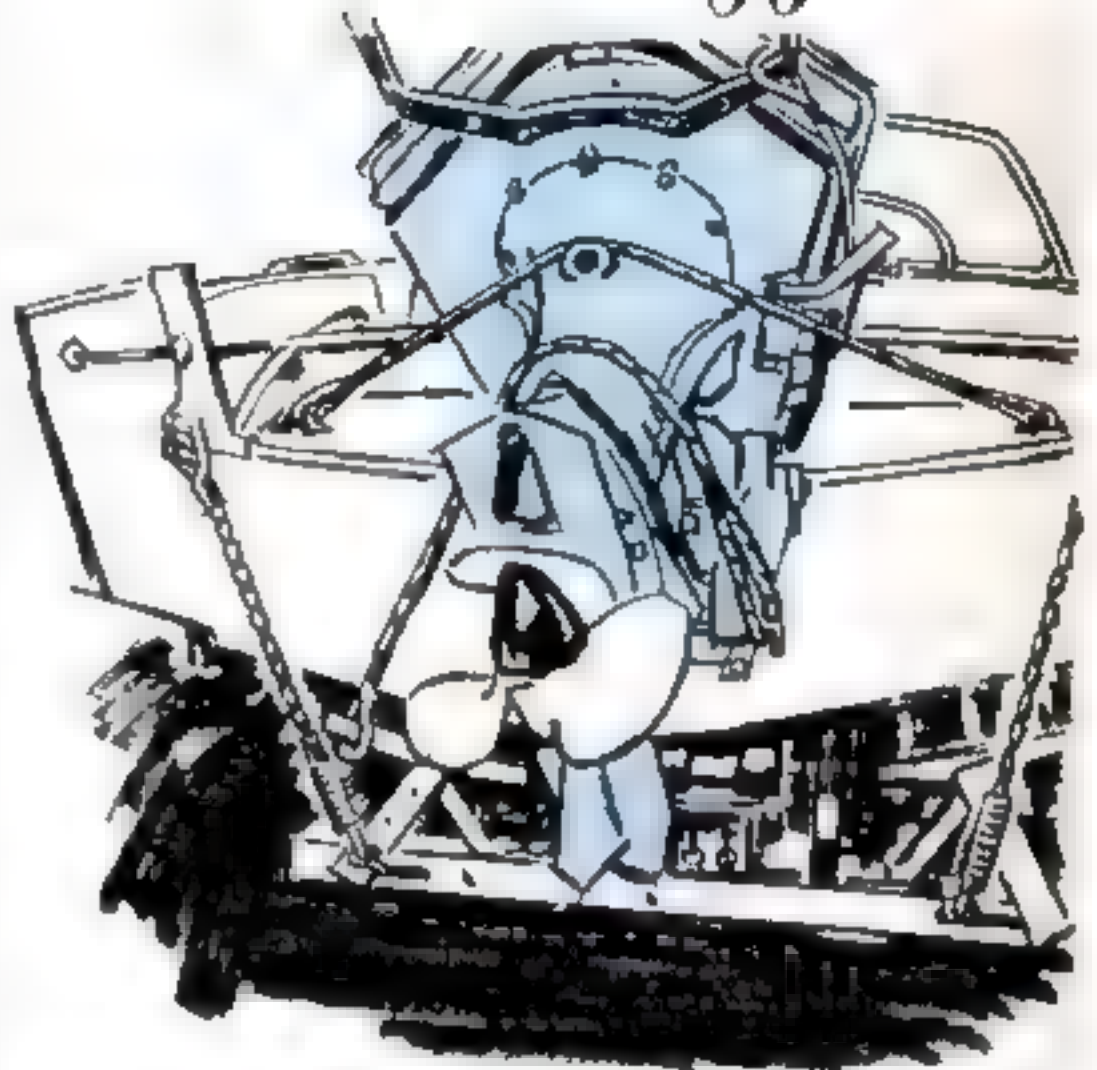
Weight can be varied by shifting trailer's cargo or by moving the wheels on adjustable-axle trailers. When towing a boat, never load it beyond the trailer's rated capacity or you may damage both the hull and the trailer.



Extra overload springs make towing both safer and more enjoyable. They eliminate rear-end sag, sway, and dangerous bottoming on bumps. Some types can be "turned off" when not needed to save removing them from the car.



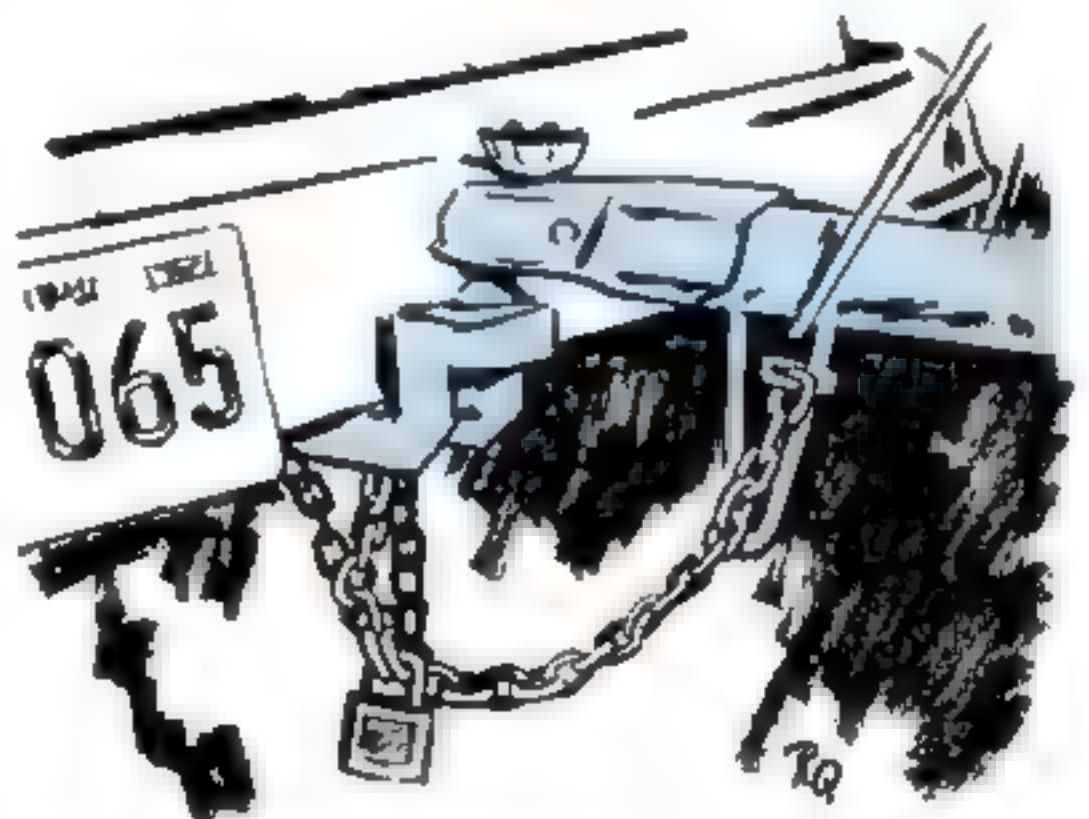
Tail lights get a soaking every time a boat trailer is backed into water, and will quickly rust out. Drill drain holes in the housings or use the clamp-on type that can be removed before launching the boat. It's a good idea to carry spare bulbs, fuses, and an extra set of trailer-wheel bearings—items that may prove scarce in the wilds.



Lash down a boat with spring-loaded chains instead of rope. They're stronger and can be quickly stretched and hooked in place. Use heavy-duty coil springs of the type sold as steering-cable tighteners, and attach S hooks at ends. Make hold-downs of elastic shock cord to keep engine from bouncing.



Never use a bumper hitch. These are now illegal in some states and aren't as safe as a three- or five-point hitch that attaches directly to the main frame members of your car. They cost only a few dollars more and are well worth it.



Worried about losing a trailer? A heavy safety chain from the tongue to your car will protect you against a faulty hitch on the road or theft when you park. Fasten it with a stout padlock.



Wet days can be fun if you've remembered to pack rain gear.

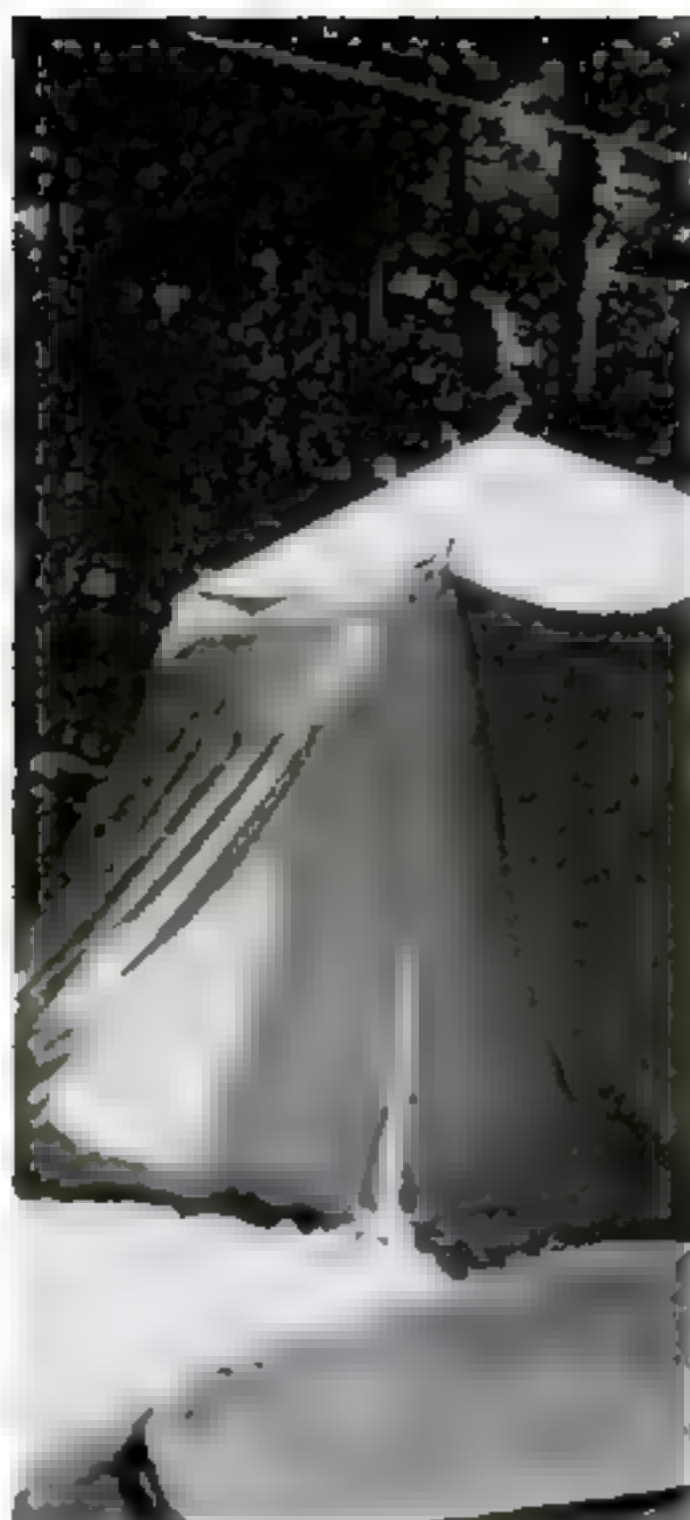
It's Gonna Rain... It Always Has

By George Laycock

THE sun's not going to shine *every* day of your vacation. But if you travel prepared, a spell of rain won't send you scurrying for home. By mak-

ing good use of modern equipment, and learning a few tips from seasoned campers, you can keep dry and snug.

When packing for your camping trip, include rainwear for everyone, as well as a few big sheets of plastic for extra shel-

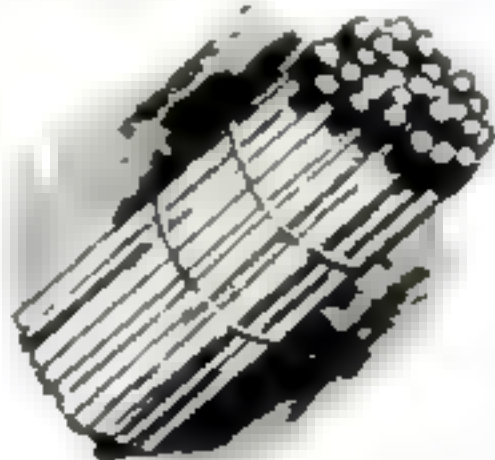


Nothing dampens spirits quicker

Six tips for starting a fire in wet weather



Build a tepee of sticks over a container of canned heat. The flame dries out the sticks, ignites them, starts bonfire.



Bundle wooden matches and dip the heads in melted paraffin to protect them from damp—or use waterproof match box.



Tote some kindling into your tent at night to protect it from rain or heavy dew. It assures dry supply next morning.



than a sodden meal. Cart along a plastic tarp to suspend over the dining area, as at right.

ters. Unless your tent has a leakproof floor, you'll want to lay plastic beneath sleeping bags or bedding—especially since most park authorities now frown on the practice of ditching around tents.

In rainy weather, keep your duffel in

the center of the tent—the driest spot. Drop the window and door flaps, and stake down the bottom of the tent so wind can't get under the floor. If you use a stove while inside a closed tent, be sure there's adequate ventilation.

.....



Soak rolled newspaper in paraffin and, after it dries, snip it into one-inch sections. They make good fire starters.



Save waxed milk cartons and bunch them beneath damp kindling. They're easy to light, burn hot enough to dry sticks.



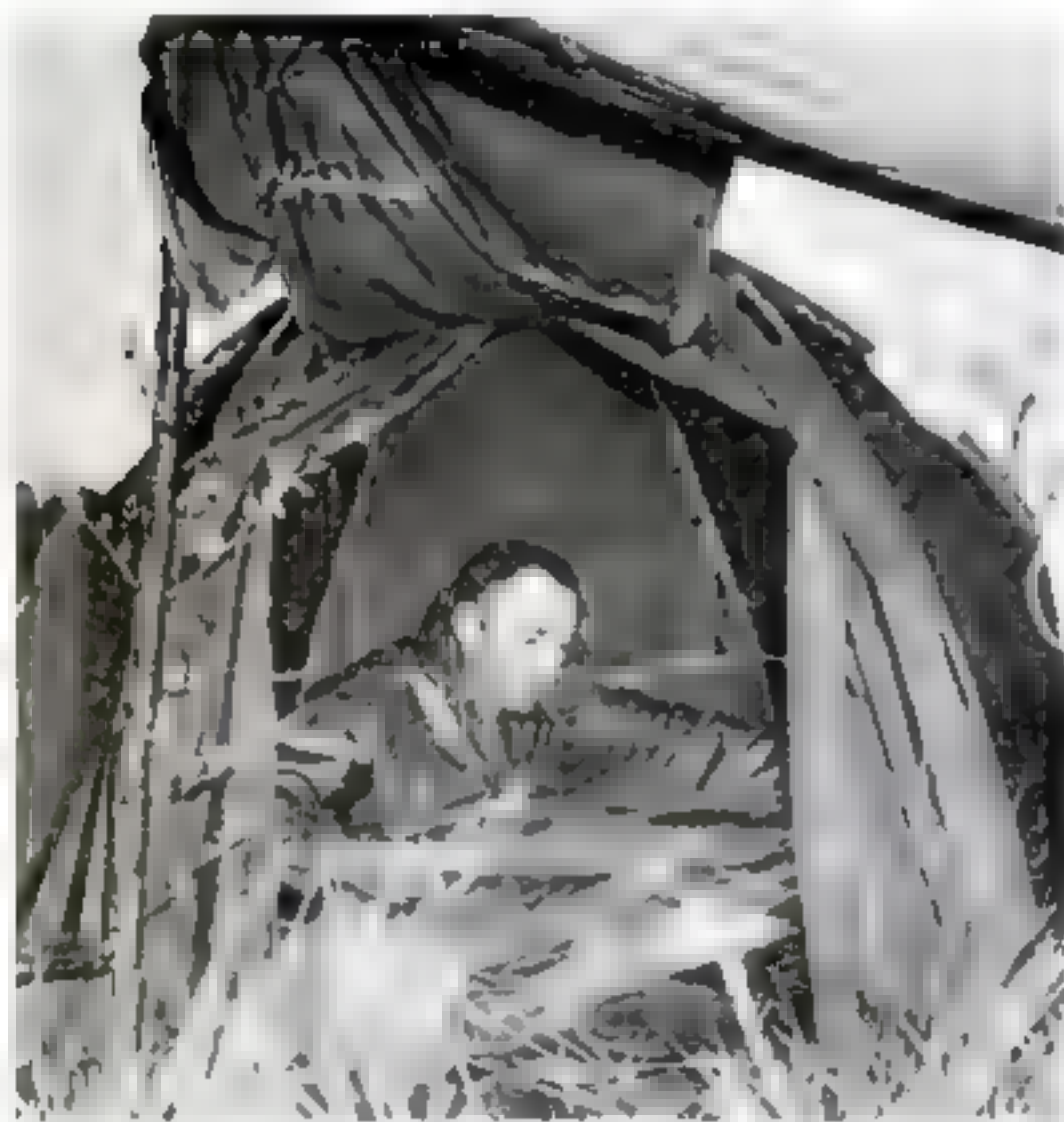
Whittle a fuzz-stick by making repeated cuts with a penknife. Stick ignites easier, serves as starter for other kindling.

CONTINUED



Canoe campers caught in a downpour can rig a quick lean-to by propping one end of the

tarp on a pole set between crossed sticks. Tarp stretched to one side broadens shelter.



Dry bedding makes all the difference in wet weather. During the day, keep bedding off damp ground by leaving it on an air mattress or a layer of dry brush. Protect it from air moisture by tucking a sheet of plastic snugly over it. On rainy days, it's best to roll the bedding, wrap the plastic sheet around it, and tie the ends shut.



Protect delicate equipment—cameras, binoculars, radios—by keeping them in Army-surplus waterproof bags. Store film and other small items in plastic bags, closed with rubber bands. ■ ■



Rasp the edges of the cut boards smooth without separating them. Then round the handles individually, to make for easy gripping.



To form nozzle, cut 4" tip off one board, glue to face of the other, and hinge. Tack valve flaps over holes through unshortened board.



Attach leather down sides to hinge line, with glue and decorative tacks spaced 1" apart. Tack hinge-hiding band around the nozzle.



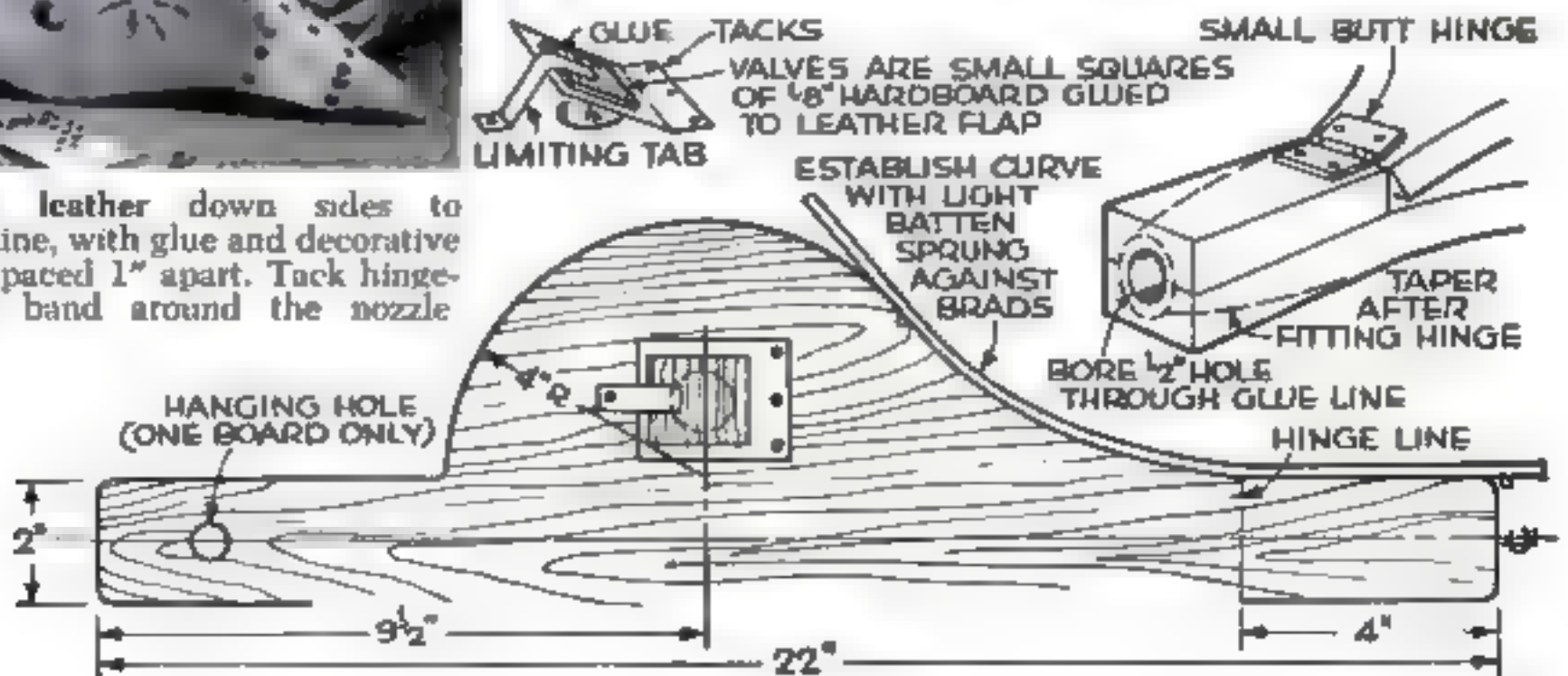
Barbecue Bellows

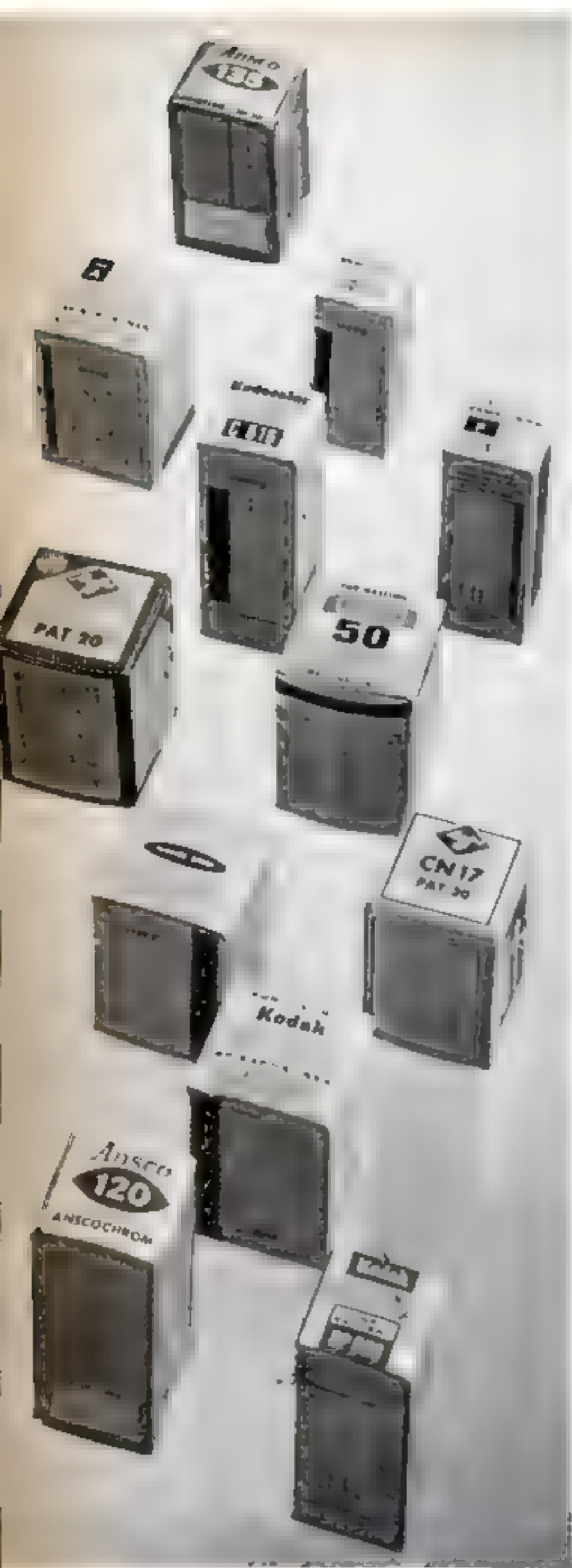
THIS copy of an Early American hand bellows was designed as a barbecue whoofer. It puffs up a storm that'll set a bed of charcoal glowing in a jiffy.

Tack together two 10"-by-22" blanks of 1" white pine and lay out the spade shape on the top face. After cutting and smoothing the boards, and gluing on the nozzle block, bore intake and outlet holes in one board and hinge the other to it. An incised design on each outer face adds a hand-crafted touch.

Chrome-tanned white leather was chosen for this model, but any soft, unglazed skin (glove calf, buckskin, pigskin) would do. Tack a temporary brace across the handle ends to hold the bellows in full-open position while fitting a paper pattern for the leather. Make the pattern in one piece, notched between the handles. Leave generous side margins for trimming.

Finish the exposed pine with resin sealer and wax before applying the hinge band.—*John Burroughs*





Confused About Color Film?

So many new ones have been appearing that a choice is difficult. Here's a roundup

By Alfred W. Lees

WHICH color film should you buy? You have good reason to be confused. Within the past year, your choice at photo counters has broadened impressively. The table on the facing page lists major color films now available for still cameras, and you can expect others to come along soon.

The most important recent developments have occurred in reversal films, the type from which you get positive transparencies. In the second basic color film, the negative type that gives you color prints, you still have only a limited choice.

Biggest news in the color field last year was Eastman Kodak's release of a long-promised higher-speed Kodachrome. First of the color films, Kodachrome had kept to an ASA rating of 10 ever since it was introduced in 1935. Now, at last, this popular film has an heir, Kodachrome II, 2½ times faster than the original.

Normally, as film speed goes up, quality goes down. But in Kodachrome II the color image is actually superior to that of the slower film. Some of the colors—yellow, particularly—are truer to nature, and the film's lower contrast gives a wider range of brightness, picking up more detail in the shadows. Eastman even claims that the new film is sharper, because of thinner, less grainy emulsion.

Kodachrome II will soon be available in Type A, for indoor use with photofloods. (It's already sold for movie cameras, with

[Continued on page 210]

COLOR FILMS

NAME	TYPES AVAILABLE	ASA SPEED*	FLASH**	SIZES AVAILABLE (exposures per roll)						PROCESSING		
				35mm.	127	828 (Bantam)	120, 620	116, 816	Sheet	Mfr.'s prepaid mailer available	Do-it-yourself kit available	Through dealer (independent lab)
KODACHROME	Daylight	10 Ph w 80 B: 5	Blue, electronic	20 or 36		8				✓		✓
	Type A (Professional)	Ph-16 3,200K w 82 A: 12 Day w 85: 10	Clear (w/81 C)	36						✓		✓
KODACHROME II	Daylight only	25 Ph w 80 B: 12	Blue, electronic	20 or 36		8				✓		✓
EKTACHROME	Daylight	32 Ph w 80 B: 12	Blue, electronic	20 †		8	12			✓	Process E-2	✓
	Type F	For flash Ph w 82 A or day w 85 C: 16; 3,200K w. 82 C: 12	Clear	20 †		8	12			✓	Process E-2	✓
	Professional	Day-50	Blue, electronic				12		✓		Process E-3	✓
	Type B	3,200K-32 Ph w 81 A or day w 85 B: 25	Clear (w/ 81 C)						✓		Process E-3	✓
"IMPROVED" EKTACHROME	Daylight only	64 Ph w 80 B: 25	Blue, electronic		12					✓	Process E-2	✓
HIGH-SPEED EKTACHROME	Daylight	160 (for fluorescent light, too)	Blue, electronic	20			special order			✓	Process E-2	✓
	Type B	3,200K-125 Ph w 81 A: 100 day w 85 B: 80	Clear (w/81 C), electronic (w 85 B)	20						✓	Process E-2	✓
ANSCOCHROME	Daylight	32 3,200K w. 80 B: 12	Blue, electronic (w/81 A)	20 or 36 †	12		12		✓	Mail direct to mfr. enclosing fee	✓	✓
SUPER ANSCOCHROME	Daylight	100 3,200K w/80 B: 40	Blue, electronic (w/81 A)	20 or 36	12		12 (no 620)		✓		✓	✓
	Type B (tungsten)	3,200K-100 Ph w 81 A or day w 85 B: 80	Clear (w/81 D)	20			12 (no 620)		✓		✓	✓
AGFACHROME	CT-18 (daylight)	50	Blue, electronic (w/colorless UV)	20						Included in purchase price		
PERUTZ	Daylight only	50 Ph w. 80 B: 25	Blue, electronic	20								
KODACOLOR	Daylight (dual purpose)	32 Ph w 82 A: 20 3,200K w/82 C: 16	Clear (but blue may be used to supplement daylight), electronic	20	8 12 16	8	8 12 16	8 16		✓	Process C-22	✓
AGFACOLOR	CN-17 (daylight)	40 Ph w 82 A or 3,200K w/82 C: 25	Blue, electronic	20	8 12 16		8 12 16		✓		N-set (film) Pa-set (paper)	✓
EKTACOLOR	Type S (1 10-sec or faster)	For flash Day w 85 C: 25	Clear, electronic (w 85)						✓		Process C-22	✓
	Type L (1 5- to 60-sec.)	3,200K-16 (for 5-sec. exp.) Ph w 81 A: 12 (for 5-sec. exp.) Day w 85 B: 20 (for 1/5-sec. exp.)	Not recommended						✓		Process C-22	✓

*First meter setting is for film's intended use, without filter; subsequent settings are for adaptations to other uses, with filter number shown. Code: Ph = photofoods (3,400K); Day = daylight.

**Wherever blue flash is recommended, clear may be substituted if a No. 80C filter is used.

†Available in bulk—usually 100 ft. for do-it-yourself loading. Anscochrome Tungsten (not listed) is available only in this form.

Our Four-Hour Wading Pool



IN ONE afternoon, you can provide a whole summer's fun for the small fry. This sunken wading pool is both easy and inexpensive to build—ours cost less than \$10. It looks more at home in the yard than a commercial type would, and is safer, since it can be drained for cleaning.

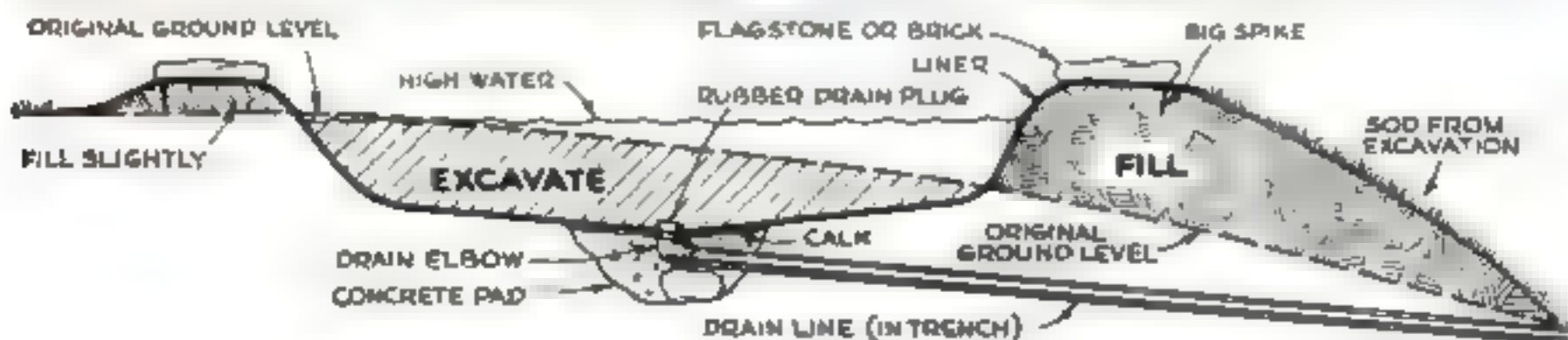
Our pool is about 8' by 8', 20" deep. It required a 10'-by-18' sheet of 6-mil black polyethylene for a double-layer lining with

1' overlaps around the sides. After tamping the earth bowl smooth and removing all sharp stones and roots, we calked the drain pad and smoothed the plastic over the bottom. We poured in a few inches of water to hold the bottom down while we anchored the sides. Then we cut a 1" drain hole through both layers of liner, inserted a plug in the fitting, filled the pool, and turned the kids loose.—J. Ramsey.



Run drain line in trench through downhill embankment formed with dirt from excavation. Slope sides and bottom of pool toward a 1½" galvanized elbow screwed on polyethylene pipe.

Coat concrete pad with calking to seal liner around drain. Also put layer of calking between sheets at this spot, to keep top one from floating up from drain, letting water leak between.



Locate pool on slope, if possible, to cut down on digging and simplify drainage. Stake edges

of liner with galvanized spikes before applying stone or brick coping to keep out dirt.

Extra Life for Your TV Picture Tube

A soldering iron, pliers, a spare capacitor—or a cheap, plug-in accessory—may be all you need to revive a dead one

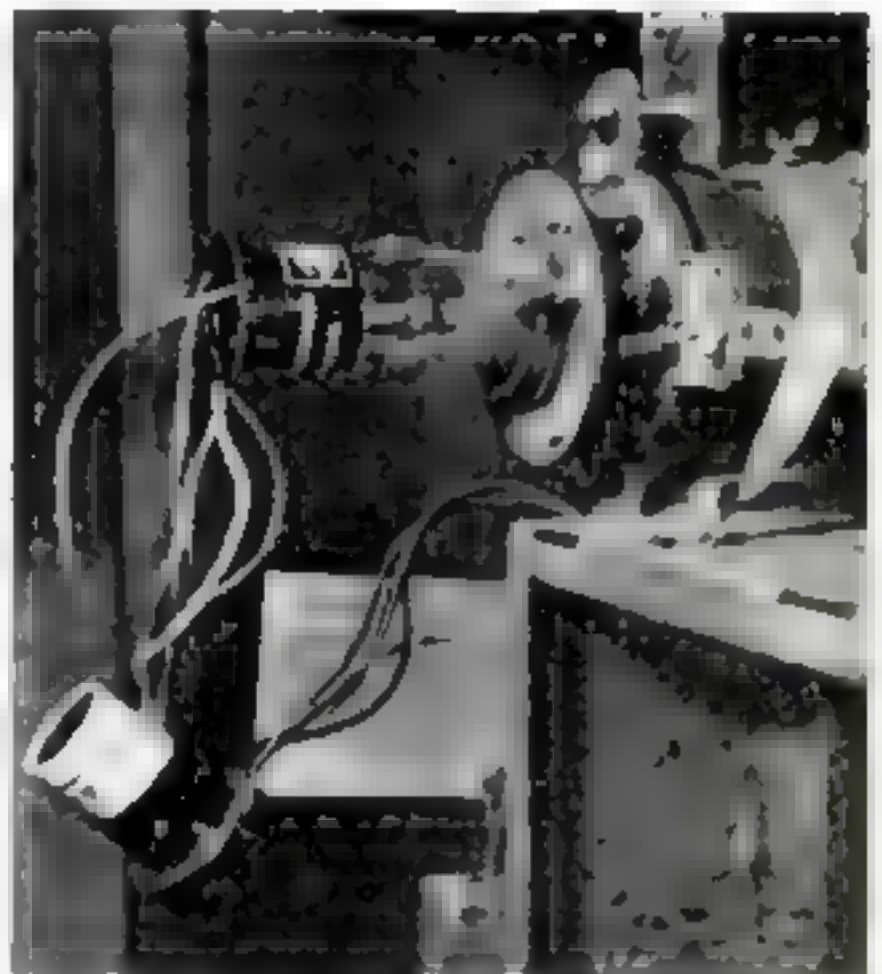
By Art Margolis

ONE out of every seven TV owners will face the expense of replacing a picture tube this year. You may well be the unlucky one. Average tube life is only 3½ years—unless you know how to give it borrowed time

Some of the tricks for extending picture-tube life are as simple as buying an inexpensive gadget and plugging it in at the right place. Others require a little more knowledge, care, and—perhaps—bravery. Tricks requiring the latter you may want to leave to a repairman. But unless you know what to ask him to try, he may not attempt to save your old tube.

There are hundreds of different picture tubes, but fortunately the prescription is almost exactly the same for each

With the back off your set (don't forget to pull the plug before you start work), you'll see a plastic cap on the end of the picture-tube neck. This is the tube socket. It makes the connections to the pins carry-



To extend picture-tube life, often the only thing you need do is to get a brightener like the one shown here (lower left). You simply plug it in—no additional wiring is needed.

ing the various voltages to the picture-tube elements. Remove this cap by working it slightly as you gently pull it off the pins. With the cap off, you can see which of the three basic types of tube you have:

Duodecal has spaces for 12 pins, although they are not all used.

Which tube brightener should you buy?

		LOW EMISSION	FIXED BRIGHTNESS	LOW EMISSION AND FIXED BRIGHTNESS
DUODECAL	Series	Duodecal series autoformer	Duodecal series iso-former	Duodecal series iso-former boost
	Parallel	Duodecal parallel autoformer	Duodecal parallel iso-former	Duodecal parallel iso-former boost
BUTTON	Series	Button series autoformer	Button series iso-former	Button series iso-former boost
	Parallel	Button parallel autoformer	Button parallel iso-former	Button parallel iso-former boost
SHELL	Series	Shell series autoformer		Shell series autoformer
	Parallel	Shell parallel autoformer		Shell parallel autoformer

Find the kind of picture-tube brightener you need by looking under the symptom you ob-

serve. Follow down the column to the line corresponding to tube and circuit in your set.

CONTINUED

Button is an eight-pin miniature base with needle-thin pins protruding from a plastic button.

Shell resembles the duodecal except there are seven pins—all used—and the neck of the tube is thin.

Now, with the cap still off, make this simple test to find out whether your set uses a parallel or series circuit: Temporarily replace the back so you can plug the set in. If all tubes but the picture tube light up, your set is parallel-wired. If no tubes, or only a few, light up, it is series-wired.

Make a note of these two bits of information: (1) type of picture-tube base; (2) type of circuit, series or parallel.

Tube-base problems. Say you've settled down for an evening of TV when you notice the brightness fading. The picture isn't shrinking—just getting dimmer. The sound is okay, but the picture keeps getting darker until it completely blacks out.

You look at the picture-tube neck. There is no glow from the heaters. When you jiggle the cap, the heaters flicker—come back on, then go off again. Your first thought: "I'm stuck 50 bucks for a new picture tube."

Hold on. Nine times out of ten you can get those heaters going again.

Wires from the elements of the electron gun come out of the neck of the tube through the glass. In the duodecal and shell type, the wires pass through hollow pins in a plastic base and are soldered to the pins. (The button-type base does not fit in this category.) The base is glued to the glass neck.

These connections may fail. The glue ages, lets go, and the socket comes loose. The solder ages and oxidizes. The wires then make poor connection to the pins. These are the main reasons for your heaters going out.

The repair is mechanical. The socket must be reglued. The new epoxy glues are excellent for this. Plastic electrical tape may also be used. To repair the open pin connection, resolder or squeeze the pins with a pair of pliers to restore good electrical contact.

Internal shorts and opens. Shorts and circuit breaks in your picture-tube electron gun are a second cause of failure. Flaking and breaking of the elements does this. While you can't get inside the glass envelope to scrape off flakes or remake breaks, you can shoot electricity into the gun or manipulate the outside circuitry.

The electron gun consists of four elements (sketches at right): the filaments or

heaters (H), coated with a ceramic insulator; the cathode (K), a metal sleeve wrapped around the heaters, physically touching the ceramic which is a thermal conductor and electrical insulator; the control grid (G1), separated by a space from the cathode; the screen grid (G2), which has a space between itself and G1.

A short occurs if the ceramic breaks down allowing H to touch K, or if metal flaking gets in the spaces between K-G1 or G1-G2.

You'll know you have a short or open when your brightness control has no effect. Your picture becomes overly bright or dim and adjustment of the brightness control produces no change.

Here's how to repair shorts and opens:

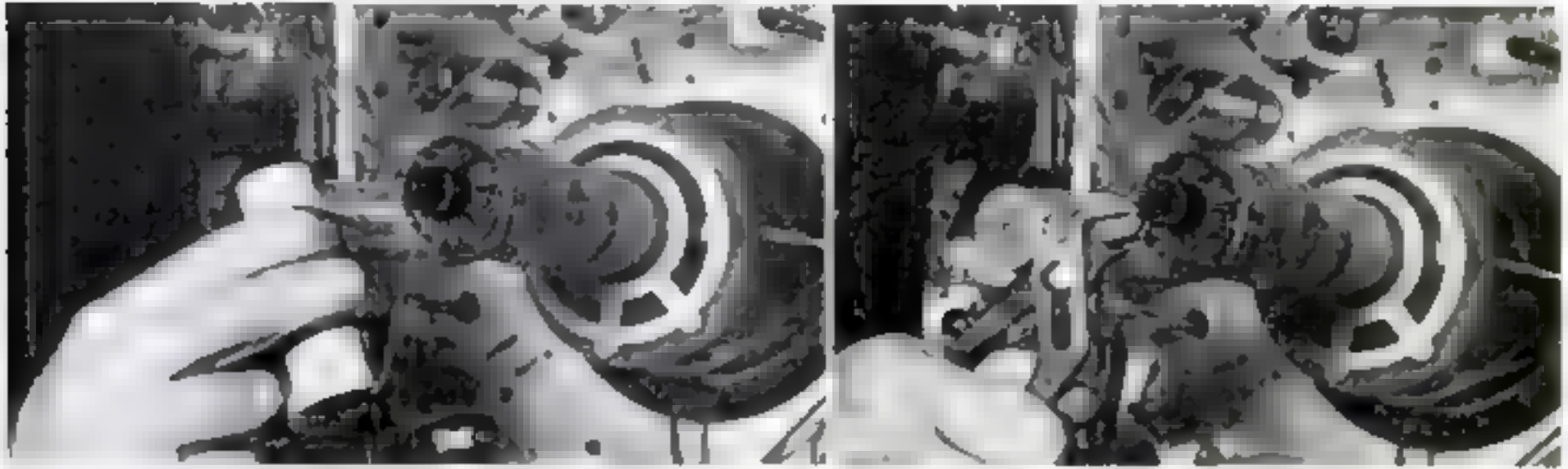
First try clearing the spaces between K-G1 and G1-G2. Get an 80-microfarad, 450-volt filter capacitor. Pull the cap off the picture tube. Connect the negative end of the capacitor to the cathode connection of the cap. Attach the positive end to the screen-grid connection of the cap. Turn the TV on for 10 or 15 seconds. This will put a strong charge in the filter capacitor. (Don't touch the leads of the capacitor or you'll get a shock.)

Touch one end (it doesn't matter which end) of the filter to K and the other end to G1. You might see a spark in the tube. Recharge the filter and then place it across G1 and G2. You have just cleared the spaces between K-G1 and G1-G2. Turn the TV back on. If your fixed-brightness condition is not gone, it means the short could be H to K. Don't try the spark fix here because the space H-K is filled with ceramic and you would succeed only in sparking through the ceramic and ruining its insulation. A different dodge is used to relieve H-K shorts.

Isolating the heaters. You don't actually fix the short, but by using a gadget called an isolation transformer, you enable the tube to go on working with the short. Here's how it works: The heaters use a low-voltage AC while the cathode works at a fairly high DC voltage. For practical purposes, these two voltages don't interfere with each other. The H to K short wouldn't hurt anything except that the heater circuit is grounded to DC elsewhere in the circuit. So if the cathode shorts out to the heater and the heater is grounded, the DC that is supposed to be on the cathode will be shorted to ground.

To get the tube working again, you merely isolate the heaters from ground. A transformer connected between the heater and

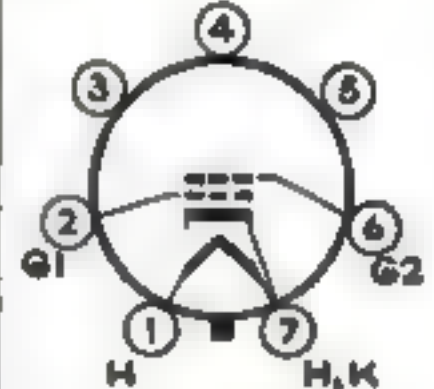
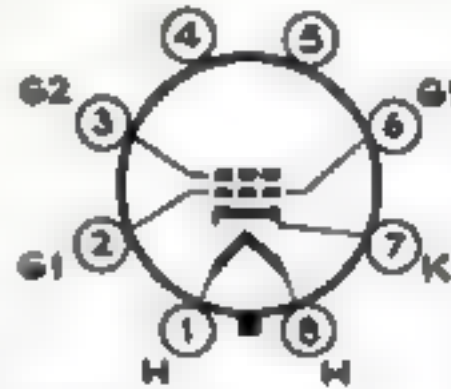
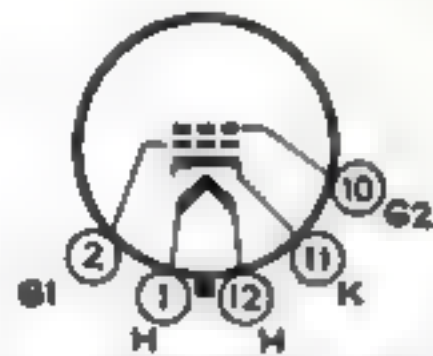
How to clear a short or fix a faulty connection



An internal short frequently can be cleared by touching the leads of a previously charged capacitor to the pins connected to the shorted tube elements. Unless you are a seasoned electronics experimenter, you'll probably want to leave this fix to your TV repairman.

A faulty connection to the heater pins may be the trouble when heaters don't light. Leads are supposed to be soldered inside the hollow pins. The professional fix is to resolder them by holding a hot iron to the pins, but pinching pins will usually restore electrical contact.

Diagrams of picture-tube bases



FUNCTION	DUODECAL	BUTTON	SHELL
H—Heaters	1 & 2	1 & 8	1 & 7
K—Cathode	11	7	7
G1—Control Grid	12	2 & 6	2
G2—Screen Grid	10	3	6

its voltage source does this nicely—AC will pass through a transformer, but DC won't.

There is one complication, though. Sometimes, when an H-K short occurs, it causes a break in the cathode. You'll know this is the trouble if, after installing an isolation transformer, you turn the TV on again and find the screen doesn't light up.

Before the repair, the open cathode was touching the heater and the circuit was being completed through the heater circuit. Now that you have isolated the heater, the cathode is also isolated. No light.

Reconnect the open cathode at the pin socket. Take a piece of wire and short the heater pin to the cathode pin, thus bypassing the break in the cathode.

Low emission. Loss of emission causes at least 75 percent of picture-tube failures.

The picture, *without shrinking*, gradually loses brilliance. Advancing the brightness or contrast control has little effect or gives the picture a silvery appearance. You first notice the condition when the TV is hard to view during daylight hours. Then things go from bad to worse till you can hardly see the screen in a pitch-dark room.

Here is what happens inside the tube: The heater heats the cathode, which is coated with a substance called thorium oxide. The action of the chemical, plus heat, permits electrons to leave the cathode and hover around it in a cloud. The action of G1 and G2 modulates and drives the electrons toward the phosphor screen face to cause light. Any lessening of the number of electrons in the cloud lessens brightness.

[Continued on page 209]

Build it . . . and watch it soar 1,000 feet in the sky:

New Model Helicopter:

By Roy L. Clough Jr.

EVER since the first helicopter got off the ground, modelmakers have been trying to design a miniature version that would do the same. Here's one of the

first model-helicopter designs to succeed really well.

Its secret? Most early models were such complicated contraptions that they sometimes worked—but more often didn't. The new one is ingeniously simple in construc-



"HERE'S a radically new free-flight helicopter," says noted model-airplane authority Howard G. McEntee, shown at left flight-testing the model for POPULAR SCIENCE. "Its ingenious engine-on-rotor-blade design is the first such I know of. It gives the model a stable, soaring flight, uncomplicated by the many problems that have plagued other copter designers for so long."

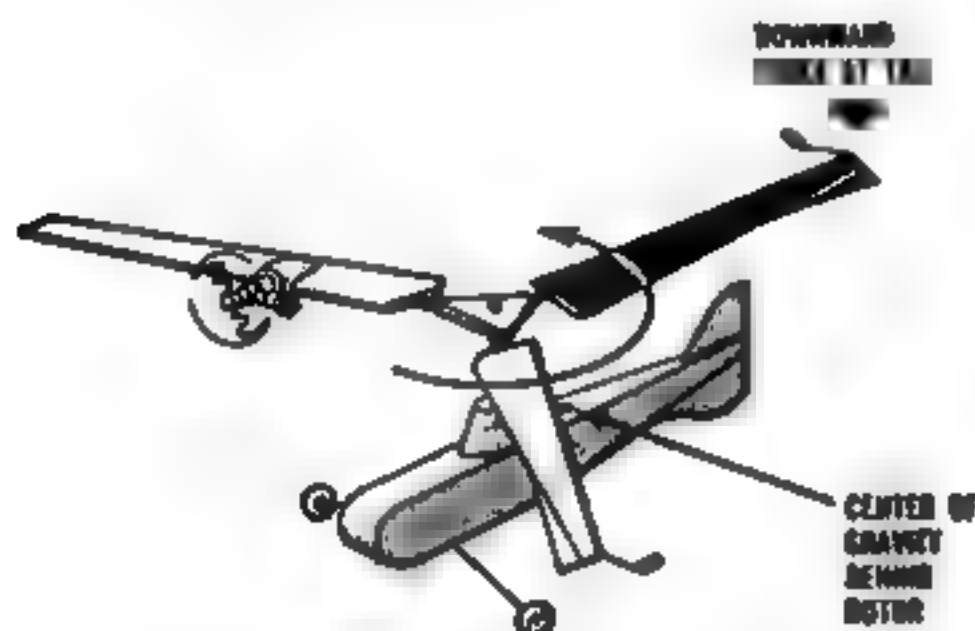


Why It Flies

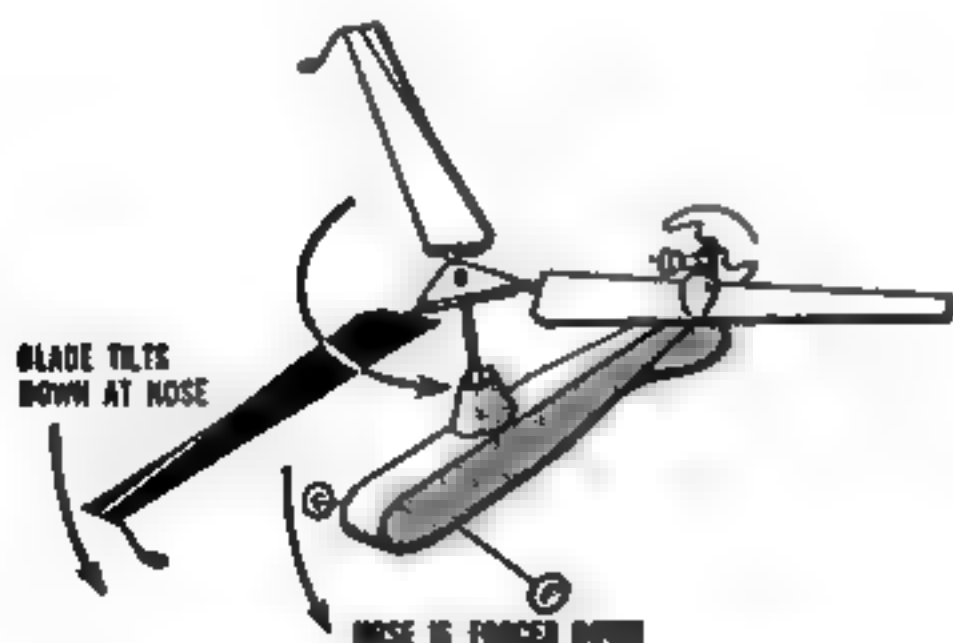
tion, yet makes use of half a dozen complex principles of flight. The result is a fascinating study of aerodynamic problems that have plagued designers of both real and model copters for years.

The power plant is a glow-plug engine

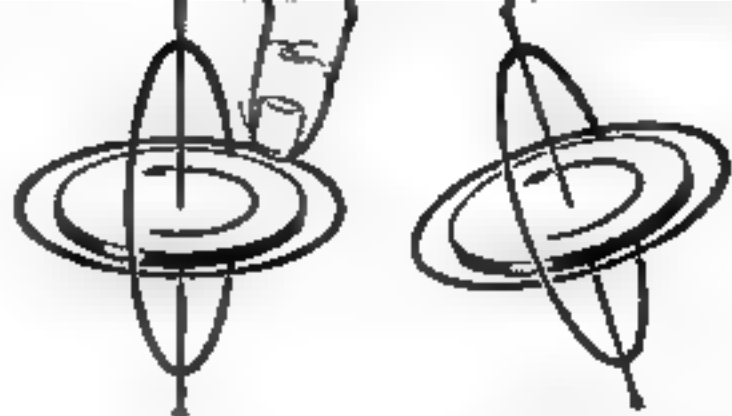
How the rotor works in flight



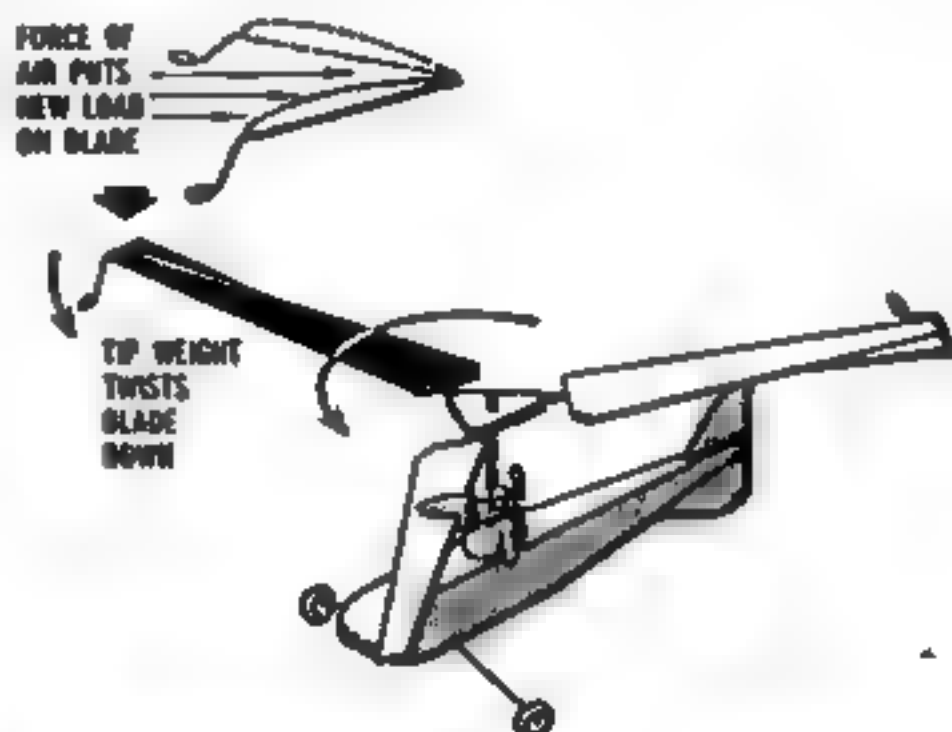
2 To keep a copter level, rotor blades must decrease pitch on forward stroke to balance reduced lift of rearward stroke—called "cyclic pitch." This is done by weighting the model tail-heavy so it pulls down on the blades at the rear—like pushing on rim of a gyroscope.



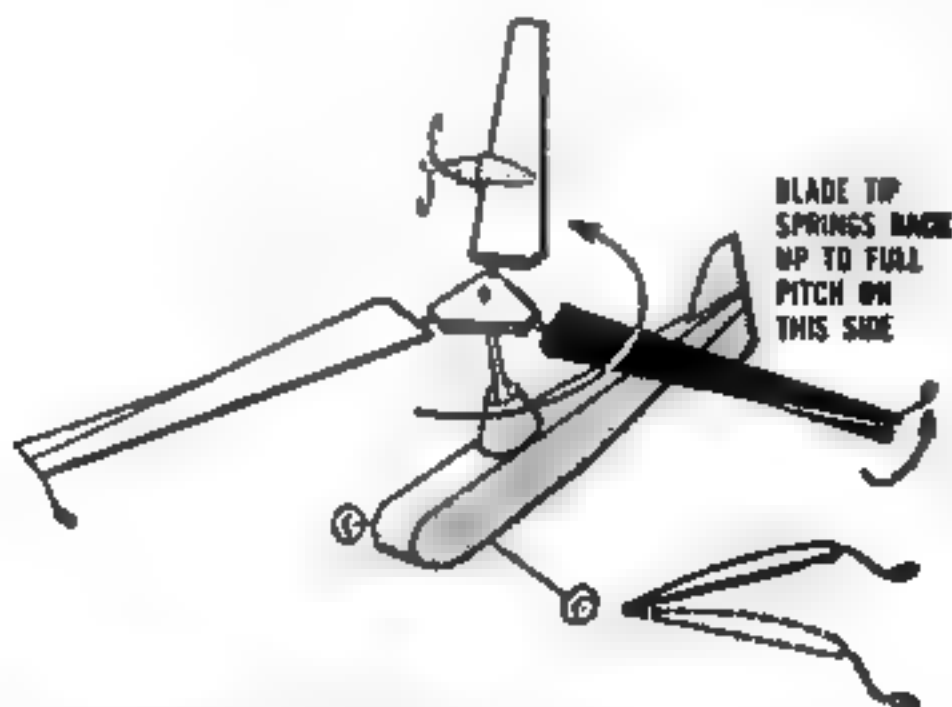
4 Blade tips, again acting as a gyroscope, react 90 degrees later to force of air on the right side by tilting down in front. This tips the nose down so the copter, while tail-heavy, tilts forward for straight-ahead flight.



1 Poke at the rim of a spinning gyroscope and it immediately tilts. But not where you touch it—instead at a point 90 degrees past where you touch it. Scientists call this "precession." In the PS helicopter, the whirling rotor acts like a horizontal gyroscope and the propeller blade a vertical gyroscope.

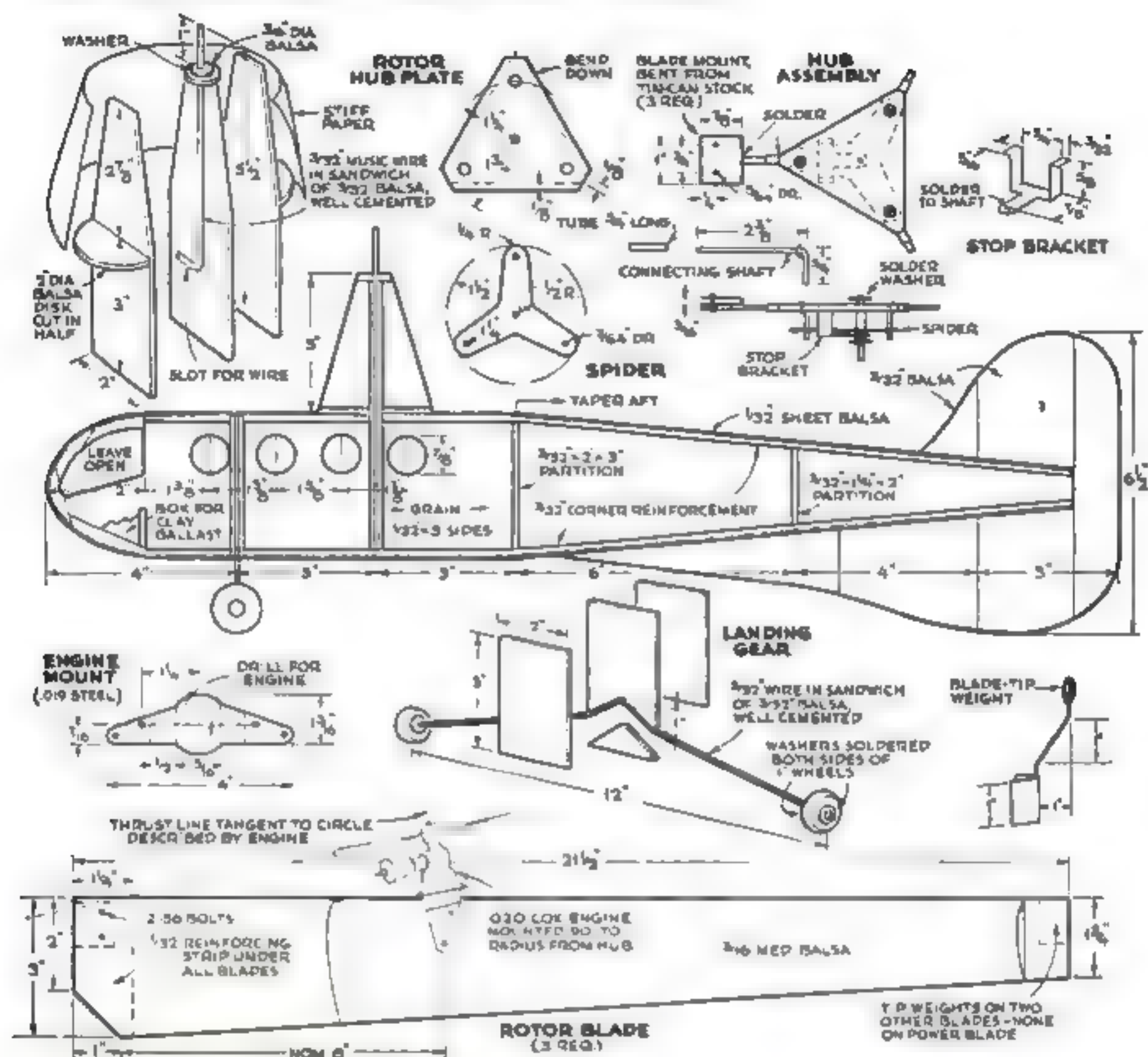


3 Whirling blade-tip weights react 90 degrees later to the force at the tail by twisting blades down on copter's right side. This reduces lift as blades advance into the wind. At same time, air pressure against the down-tilted blades exerts a new force on the rotor



5 Blades spring back up on left side to take full bite of air. Since lift is less on rearward stroke away from the wind, the full-pitched blades now balance reduced-pitch blades on opposite side, and the copter flies level.

How you can build the gas-model helicopter



Underside of rotor hub shows how spider forces two nonpowered blades to tilt at same angle as powered blade. Wire blade stems are bent at right angles to engage holes in spider plate. Solder parts with hub held flat, upside down, to insure uniform alignment of the blades.

like that used in most model planes. But instead of being mounted inside the fuselage, the engine is attached directly to one of the copter's three rotor blades. In most conventional copters, both real and model, the engine drives the rotor from a central shaft. In turning the rotor forward, it "braces its feet" against the fuselage and also pushes backward. This backward torque keeps attempting to spin the fuselage in the opposite direction from the rotor.

In full-size copters, torque must be offset by a separate stabilizing tail rotor or other special devices to keep the craft flying straight. In the model shown here, the blade-mounted engine pulls the rotor around instead of pushing it. It creates no

torque and thus needs nothing to counteract it.

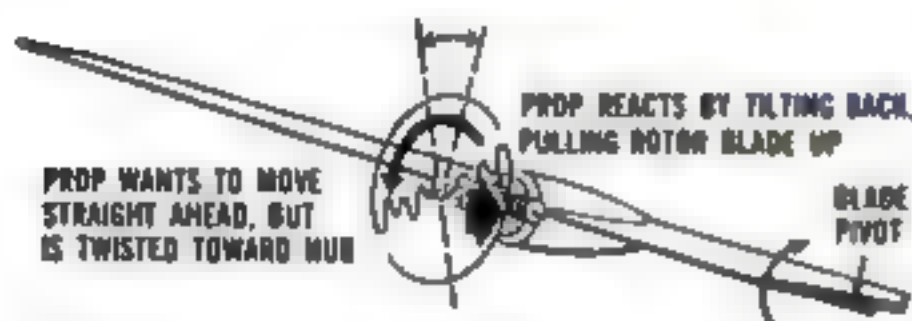
The model is a whopper, too—nearly 4' across the rotor tips. Yet, despite its size, it's so efficient that it flies on a tiny .020 Cox engine—one of the smallest made. Designed for free flight, it has hit altitudes of 1,000 feet on two minutes of fuel, giving it a rate of climb of 500 feet a minute. Earlier models have required much bigger engines to achieve the same lifting power.

How the model flies. The three rotor blades are pivoted loosely at the hub, leaving them free to tilt up or down like the elevator on an airplane. The blades are also linked together at the hub by a bell-crank mechanism so that whatever one blade does, the other two do likewise. Unlike a conventional helicopter, however, no special controls are needed to tilt the blades up or down for takeoff or landing, or to provide complicated changes, known as cyclic pitch, during flight. They're automatic.

The trick is based on the fact that the whirling rotor and the spinning propeller

[Continued on page 188]

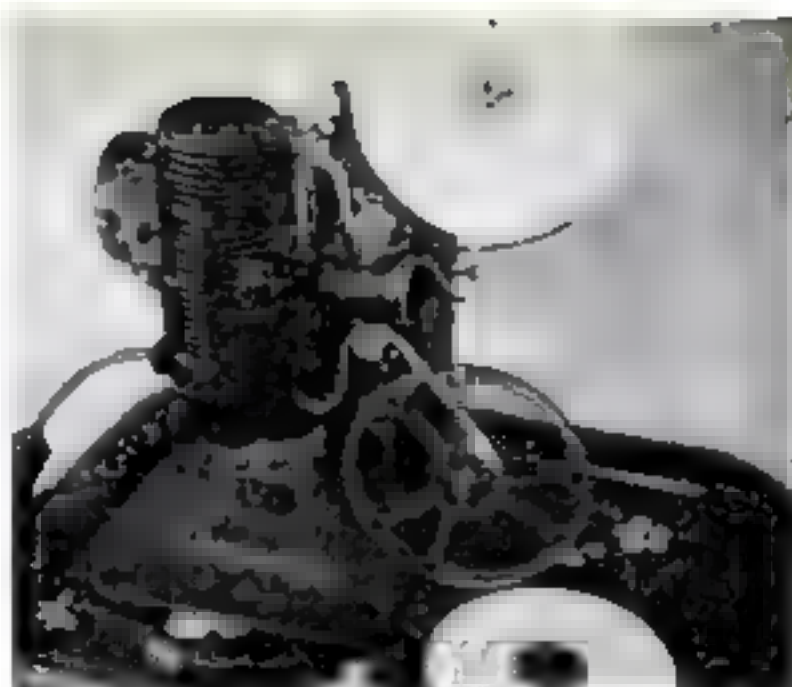
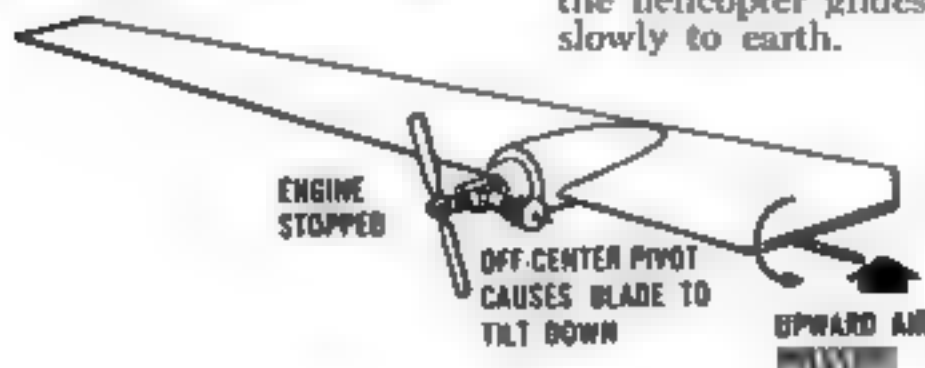
How the model climbs



Whirling propeller acts like a gyroscope in the same way as the rotor, but this time in a vertical plane. It reacts at 90 degrees to the sideward twist on it by tilting upward. This tilts up the rotor blade (and the other two blades linked to it), giving the helicopter lift for climbing.

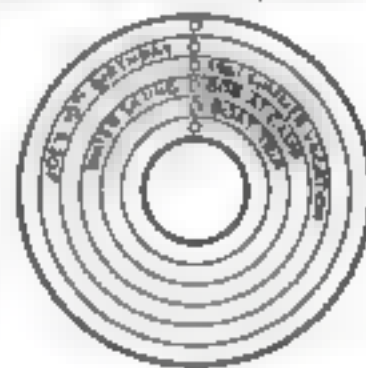
How the model lands

When the engine quits, the upward gyroscopic twist on the rotor blades also stops, and they pivot freely. Upward air pressure on the trailing edges forces the blades to tilt down, and the helicopter glides slowly to earth.



Perforated disks index movie reels

Cardboard disks cemented to movie reels will give you a handy index for finding any film subject. Make concentric circles $\frac{1}{8}$ " apart on each disk and punch holes (in a row) between the lines. Now run the film. At each hole, write in the subject at that point, and you have a record for quick reference later on.



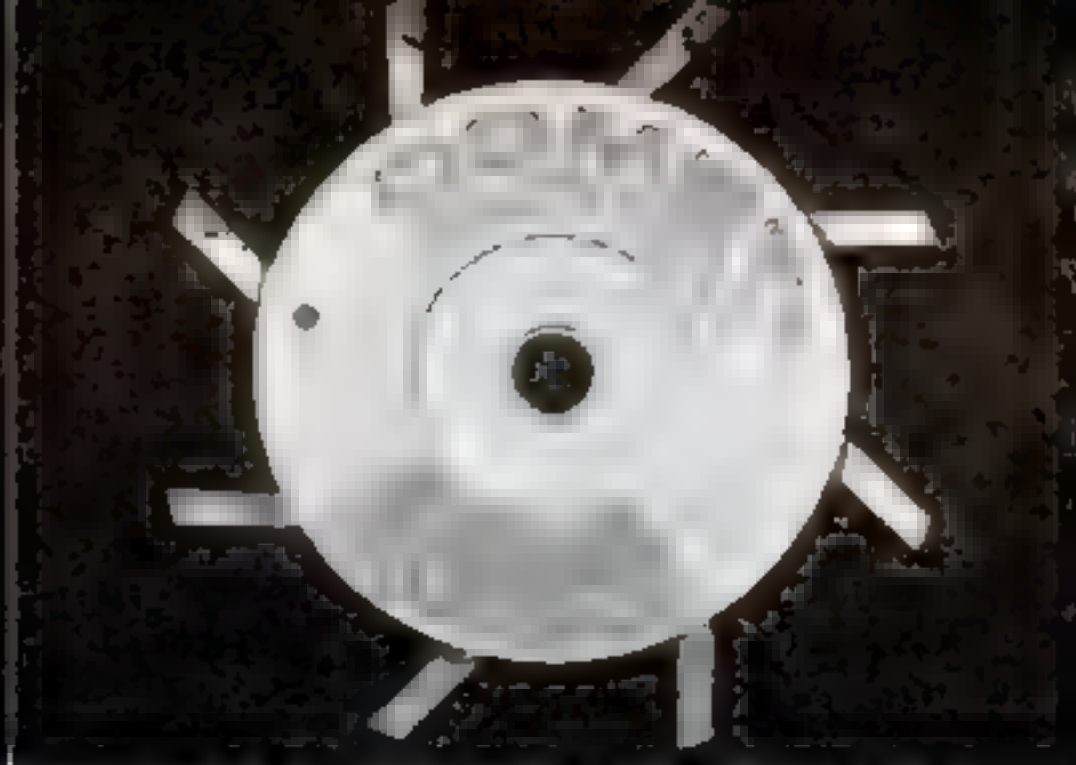
Quick tie-down for tent or tarp

A shower-curtain hook and a small rubber ball slightly bigger than the hook's opening are all you need to attach canvas or thin sheet plastic to a tie-down rope. It's a neat way to anchor tents, boat tarps, furniture covers, and the like since it requires no grommets, can't pull loose even under heavy strain, and won't damage the material.

Gather the material around the ball and fasten the hook around the gathers, with the ball on the outside. The ball will keep the material from pulling through the hook and provide a firm, tearproof anchor for the tie-down rope. A soft ball will give you the snugest wedging action.—Erik Miller, Sherman Oaks, Calif.



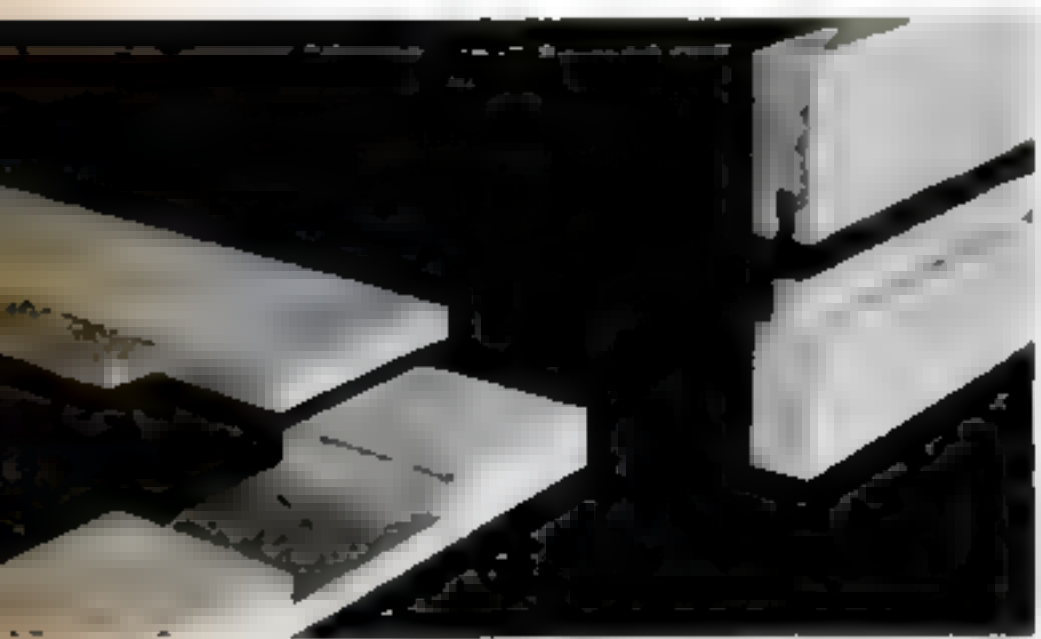
In sandwich dado, width of cut is varied by the number of narrow chipper blades you insert between the two full outside blades. Cut is flat bottomed if all teeth are jointed level.



One of a kind, this Quick Set has studlike knives around a center disk. Cut width is varied by tilting disk between tapered outside plates so knives sweep a wide or narrow swath.

When You Buy

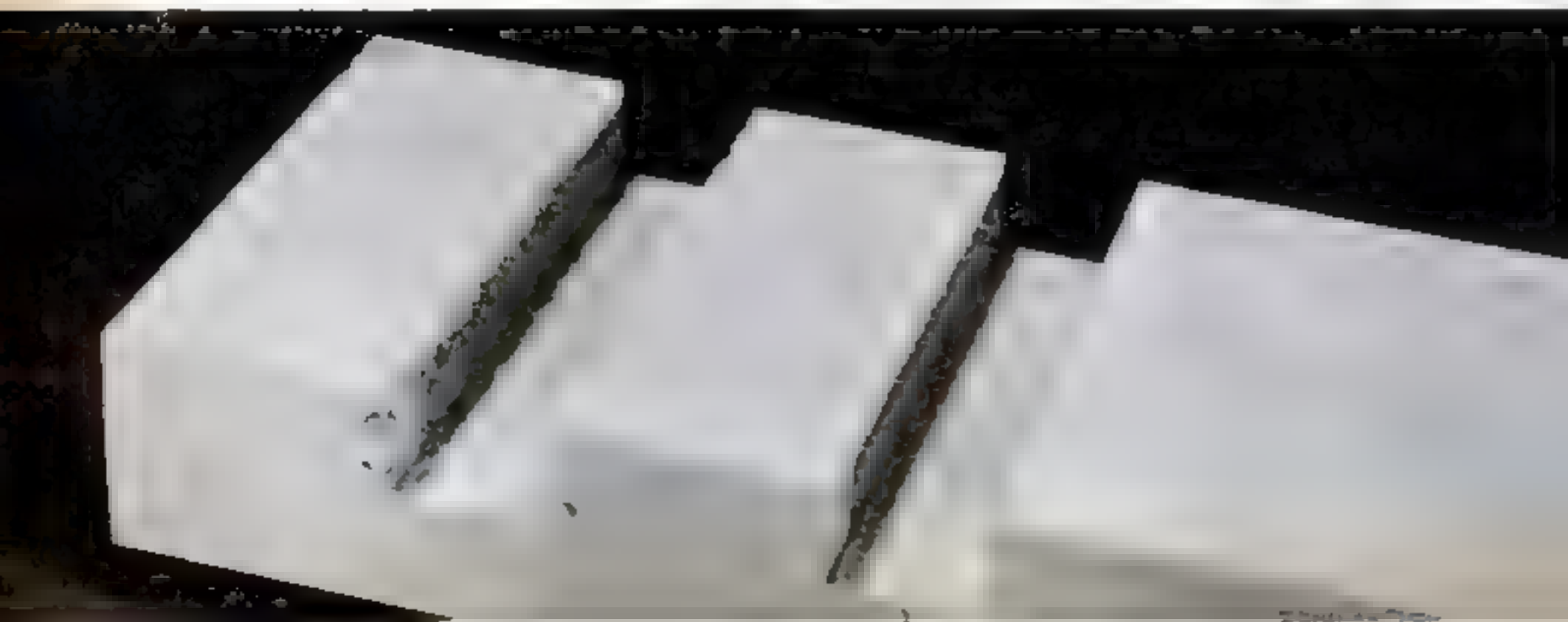
By R. J. DeCristoforo



Skill is important, no matter what type of dado you use. If you want to turn out perfectly mating joints like the half-lap and tongue-and-groove above. Below, both cuts were made with the same tool, but the ragged one at left was spoiled by rushing it through.

ENTER a store that specializes in dado-cutting tools and you may be awed by the variety and stunned by some of the price tags. Some sell for up in the hundreds. Even for home-shop use, your choice would run all the way from \$4 up to about \$30.

You'd see solid blade dados that act like a single thick saw blade to cut only one particular width. You'd see thin blades that wobble back and forth to cut a wide groove. Also represented would be conventional dado assemblies that use a sandwich of several blades to vary cutting width, plus a special type called Quick Set, that looks more like a horn-studded sea mine than a





Two types of wobble dados: Self-contained unit is shown above, a set of tapered washers at right. Self-contained wobbler comes with its own blade, has a geared hub you rotate with

an Allen wrench. The washers can be used with any blade. Both work by tilting the blade so it wobbles from side to side, cutting a slot. The greater the tilt, the wider the cut.

a Dado

dado. There would be impressive-looking units with carbide-tipped teeth selling for \$70 or more.

It would be nice if we could just take home one of each. Since we can't, we have to make a choice.

What's a dado for? It's for more than just cutting a U-shaped groove in a board. It's for cutting rabbets, making tongue-and-groove joints, forming spline grooves, cutting tenons and slots, forming half-lap connections, panel raising, coving, and spiraling.

A dado is also for duplicating exactly, next week or next year, a cut you're making right now. It's for doing in one pass and a few seconds what would take you much more time and energy with a regular saw blade and many repeated passes. It's for doing that operation more smoothly and more accurately. It's for shaping mating cuts on different pieces so they'll match perfectly. No dado will be called upon to do all these things in exactly the same way, but a good one should be able to do many of them.

The ideal dado. To my mind, the most efficient dado will be infinitely variable between its maximum and minimum settings and will not be limited in depth of cut. It will cut smoothly with minimum feathering to produce square-sided, smooth-bottomed grooves. It will have sufficient side clear-

Tests show how type of dado used and technique affect a cut



Smooth cuts like this were made by an expensive, perfectly jointed sandwich dado and also by the Quick-Set. The wide hollow took several passes, but looks like a single cut.



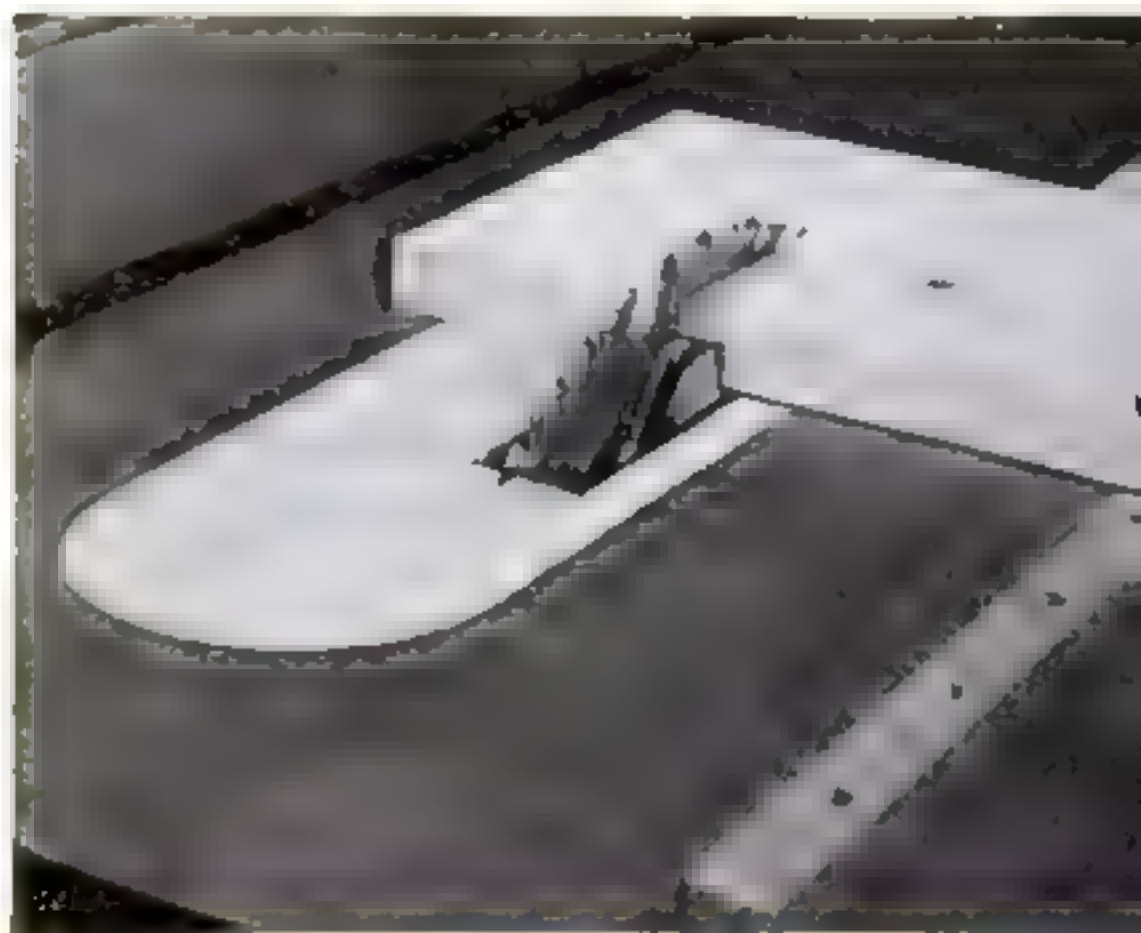
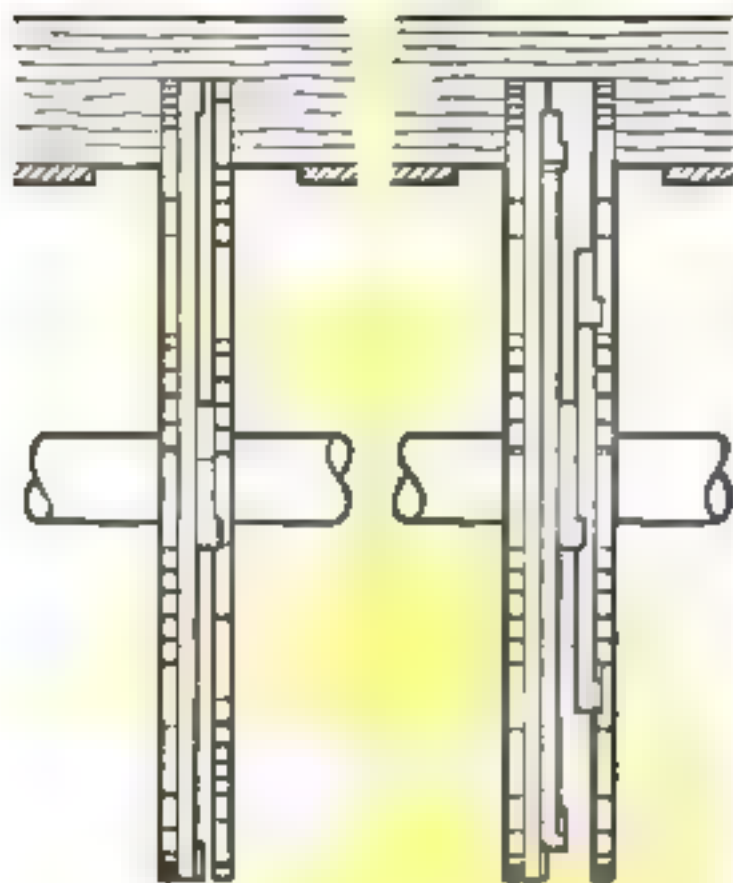
"Railroad tracks" showed up when an inexpensive sandwich dado was tried right out of the box. Ridges are caused by poorly jointed teeth, but could be lessened with more passes.

A series of scoops is unavoidable with a wobble-type dado, but needn't spoil the cut. The remedy: Make additional passes overlapping the original ones to clear away the high spots.





The sandwich dado is accurate, makes trick cuts



You can cut a rabbet in a single pass by combining a sandwich dado with a regular blade like this—a trick not possible with other dados. Cut width is varied by number of chippers used between outside blades, as at left. Bottom is flat because all cutters are parallel.

ance in the cut to prevent burning. It will not splinter plywood.

The U-shaped cut should hug with enthusiasm or grip indifferently as the operator wishes. This is so you can get a tight fit for a bookcase shelf, or a sliding fit for a drawer guide or runner.

All of the tools in the store will do many of these things. Many times a choice is made because of one particular feature and, almost always, it must be made within a price range. No point in mooning over a \$75 hollow-ground assembly if your budget allows \$5 or \$10. But it would be just as wrong to buy a low-quality item merely for the sake of saving a few dollars. This is poor economy because you'll almost surely end up buying another unit and wasting your original investment.

How the wobblers work. About \$5 will buy you a set of wobble washers. These work in the same way as a complete wobble-blade assembly except that they can be used with any regular saw blade to give it a wobbling motion. Self-contained wobble-blade units, like the Magna Dado, give you the whole works for about \$20.

Either way, the wobble blade is mounted slightly off vertical to the saw arbor. As it spins around, its teeth move from side to side, cutting a wide slot instead of a narrow kerf. The greater the tilt, the wider the cut.

Because the blade swings back and forth in an arc, it makes the bottom of the dado slightly rounded instead of dead flat. This may or may not bother you. It isn't terribly critical in an ordinary dado that's concealed and doesn't depend on its bottom surface for strength. But in the few jobs where squareness is essential, as in a rabbet or the shoulder and cheek of a tenon, it can be annoying.

With separate washers, your choice of blade is important. A blade that is not jointed correctly or that has unevenly set teeth will produce a rough cut. Extremes in these conditions will throw the blade out of balance and produce a cut that's uneven as well as rough.

Best results are obtained with a heavy-gauge hollow-ground blade with cutting teeth plus a raker-tooth design. Blade di-

[Continued on page 194]

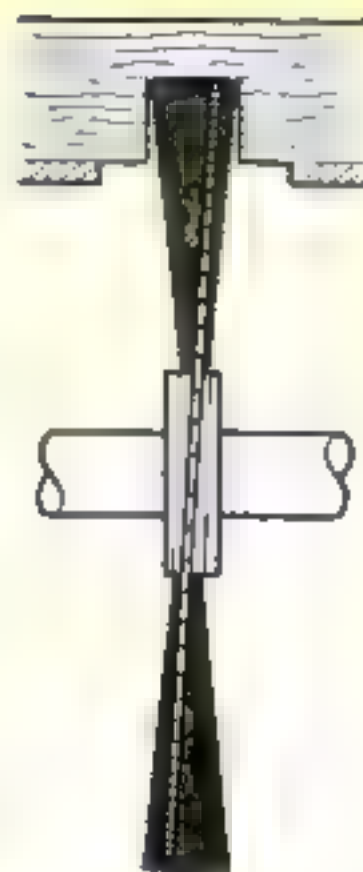
A wobbler gives you infinitely variable cuts



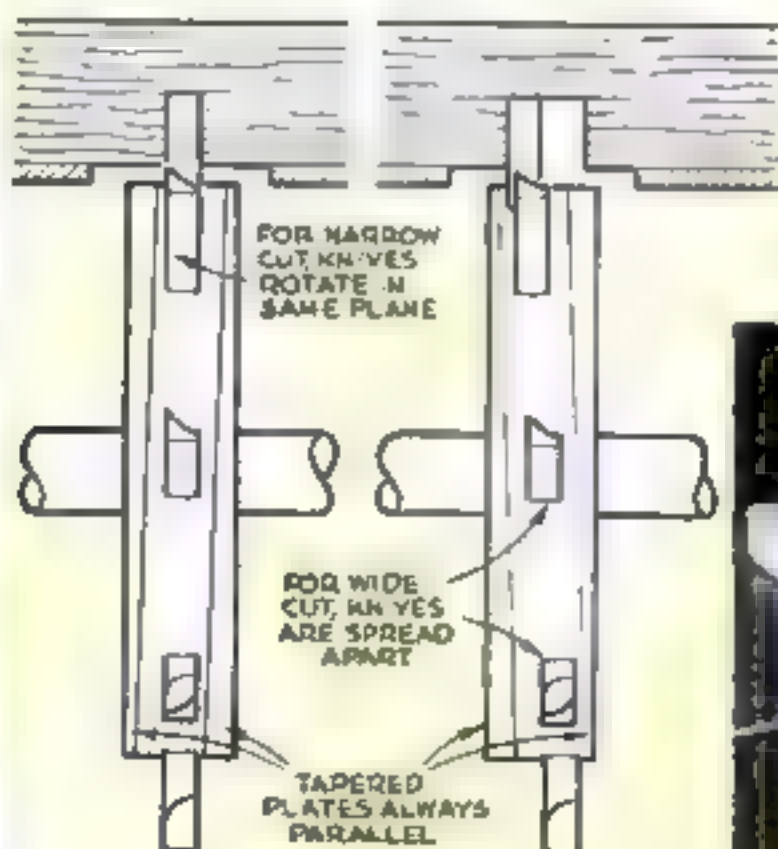
You change cut width by simply varying blade's tilt. But watch speed, too. Dadoes above were made at same settings, but slower blade at right "relaxed," cutting a bit wider.



A gauge strip containing sample cuts helps determine correct settings since width of wobble can't be measured with blade at rest. Note slightly curved bottoms, caused by blade's arc.



The Quick-Set is part wobbler, part flat cutter



You get a flat-bottom cut at maximum width, as shown at left, because blades are pointed level in that position. Blades tilt one way to line up for a narrow cut, the other way to spread out for a wide cut. Like a wobbler, width settings are continuously variable.

You can cut a cove crosswise because of tool's large beveled teeth—as true a cove as you can get. On other blades, work must be fed obliquely for cove effect.



How to Carve Your Own Totem Pole

That old Indian status symbol can be used decoratively nowadays in and around a paleface's modern "tepec"

By John Burroughs

IT MIGHT be stretching a point to say that every family should have its own totem pole. It's no longer the status symbol it once was to the Indians of the Pacific Northwest. All the same, it's a mighty interesting chunk of wood sculpture, for those aboriginal craftsmen turned out some masterful carvings. Your copy may not be a work of art, but it can make a truly decorative addition to a den (see facing page).

The original poles were not just for looks. They were erected at great ceremonial feasts given by wealthy chiefs to proclaim their prestige. The crests on a chief's totem symbolized his lineage. The top character usually represented his mythological progenitor, from whom the clan took its name: A chief of the People of the Raven, for example, would top his pole with a representation of that bird. Other crests in descending order

CONTINUED



Authentic poles—now weathered and teetering—still stand at sites of old Indian villages in Western Canada. Zealous missionaries chopped many down, but about 300 remain.

How totem poles are being used in the Pacific Northwest

As a house ornament.



As a lawn ornament.



Small one as a lamp base.



You use both hand and power tools to carve this



Chop sapwood off a red-cedar log; it's the outer layer of white wood, about 1" thick. Plans (far right) call for log about 18" in diameter, 7½' long. It's easier to work if you split off one side (using wedges) to form a flat



Lay out pattern with a grease pencil, after establishing a center line by stretching string between nails. Divide log into segments corresponding to heights of individual crests. Draw a sketch figure or mark face of log in squares



Rough-carve the forms with a razor-sharp, broad-bladed hatchet, driving it deep with hammer blows to slice off good-size chips. Rough entire pole to shape before carving any details. When through, redraw cutaway lines



Keep features symmetrical by tracing around cardboard templates for eyes and other details. Coarse rotary rasps in an electric drill or flexible shaft are handy for shaping concave eye sockets and rounding saucerlike trises.

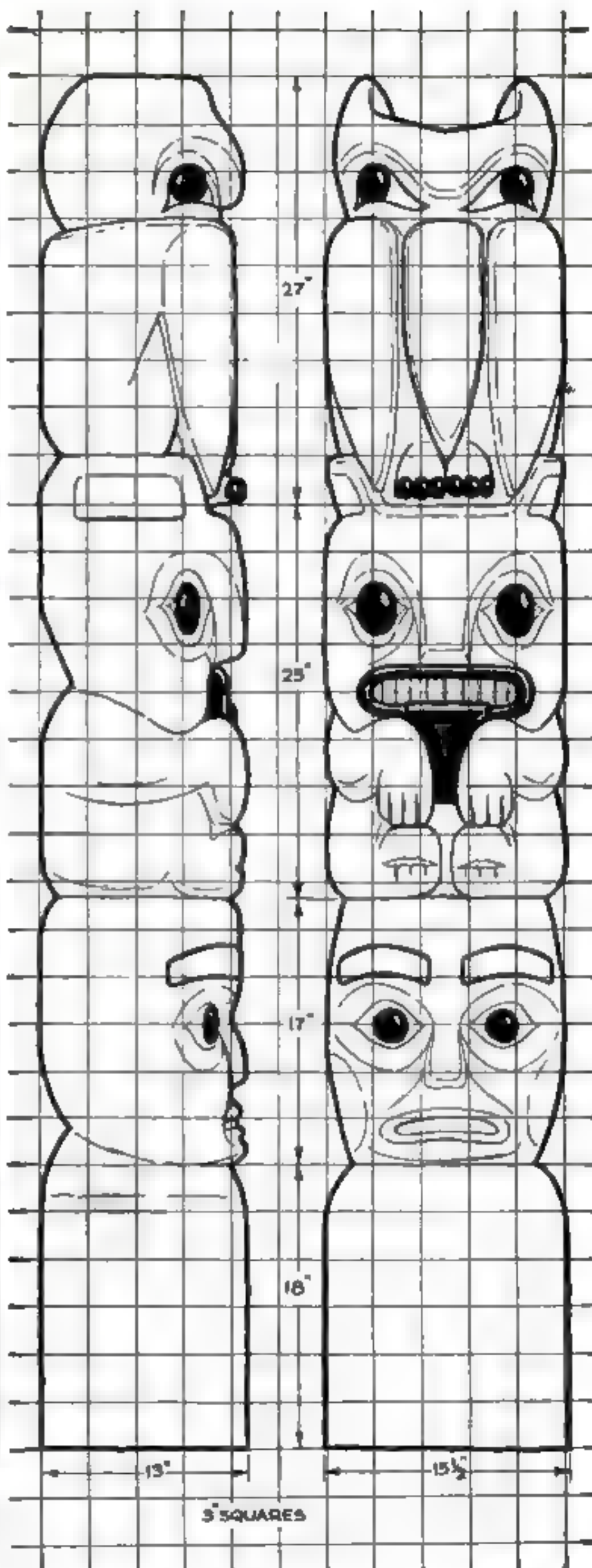
seven-foot pole



Portable circular saw, equipped with a carbide-grit cutoff wheel, plows grooves between figures and scoops out concavities fast. Scrub wheel occasionally with alcohol to clean off gum and impacted wood.



Sharp chisels and gouges, whacked with a mallet, are best for finish-carving. Remove shallow chips, leaving a regular pattern of tool marks, as on most authentic totem poles. Don't sand—just apply finish.



CONTINUED

might represent illustrious ancestors or recall tribal triumphs. The bottom figure, "the low man on the totem pole," usually represented the chief himself.

No two totems were alike, not even those of succeeding leaders of the same tribe. The design of a pole was a chief's personal property, and the right to use certain crests a jealousy guarded prerogative. Each chief had his own story to tell. And there were many ways to represent the same mythological figures.

On most old poles you can identify individual crest characters—Raven, Wolf, Beaver, Grizzly, Thunderbird (a cannibal), Killer Whale, Mountain Eagle, Sea Monster, Sculpin (bullhead), Sun, Frog, Mother-in-Law, Chief (man's head), and others. And sometimes, if you're familiar with regional folklore, you can guess which legends the crests portray.

Carving your own pole, in case you're itching to try your hand at it, isn't difficult once you've established a design. You may be able to get a suitable log from a pole and piling firm. They often sell butt ends at \$1 to \$2 per foot.

Our design for a seven-foot pole is purely decorative, with no particular symbolism. We chose three characters that figure in many legends of many tribes. If you need an interpretation for insistent guests, you might try this: Explain solemnly that the design symbolizes man's evolution from sneaky primitive (Raven) through conquering warrior (Grizzly) to lord of the earth (Chief).

If you'd rather design your own pole, adapt crests from old poles pictured in books or tourist literature.

Indian carvers cut their totems in red-cedar heartwood. To get at the heartwood of a red-cedar log, they removed an encasing layer of tough, elastic white sapwood, an inch or so thick, which would rot if exposed to weather.

The Indians used a clever tool called a D adze, made by lashing a razor-sharp, chisel-like bit solidly to a D-shaped wooden handle. After hand-adzing the crests to shape, they added details with small gouges and knives.

Most totems look best when given an antique finish. Easiest way is simply to scrub the pole with brown-black stain. Another "weathered" finish—better, but considerably more work—involves lightly charring the cedar with a blowtorch, scrubbing away the char with a wire brush, and then sealing the pole with brown-toned penetrating resin.

The coloring. Authentic poles usually—but not always—were tricked up with colored paint on important details. The Indians used corroded-copper blue-green, rich rusty red, root-juice yellow, smashed-burned-clamshell white, charcoal black, and several shades of earthy brown. They ground pigments in a chewed-salmon-egg vehicle to form a sort of tempera. You can mix alkyd-base enamels to simulate these colors.

Northwest Coast carvers erected large poles with A frames and levers. The butts of the poles were set in holes dug to bedrock in front of the clan's long-house. The crests always faced seawards. Slaves were sometimes killed and placed in the pole holes as part of the ceremony.

Simply burying the butt is adequate footing for a small ornamental pole set in a yard or garden. When architects use totems as columns, however, the poles generally are set on permanent poured-concrete bases and lag-screwed to welded structural-steel supports embedded in the concrete. Erected in this manner, the seven-foot pole for which we've presented plans would make a striking ornamental post for a patio cover. Or it might be set up beside a boat landing—facing the water, of course. ■ ■



Low man on the totem pole was actually top dog. The bottom face or animal was often the personal crest of the chief who commissioned the carving. It brought the picture-story genealogy up to date. Top figure told origin of his tribe.



▶▶▶ Some stores that service certain electric razors won't sell you spare parts. When I needed new motor brushes, I bought a carpenter's pencil and cut off sections to proper

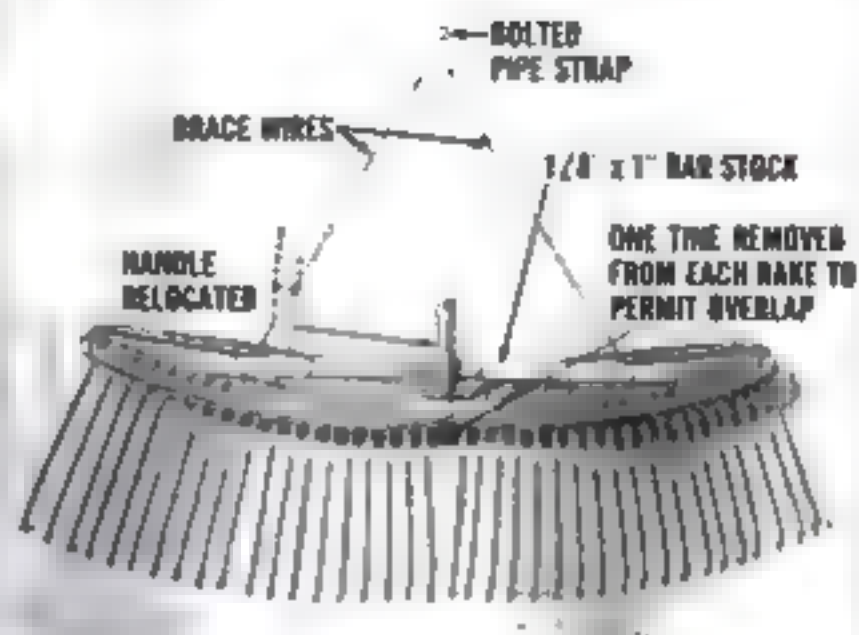


Tap-wrench improvements

Plastic grips on a standard tap wrench (above) save your hands when you have a lot of holes to work—and provide greater leverage for large taps. In corners, you can

Short Cuts and Tips

FROM PS READERS



Siamese-twin grass rake

Sweep a wide swath—and cut the chore in half—by joining two bargain rakes into a king-size one. Remove both handles (I just drilled through the spot welds) and a tine from opposite ends. Overlap these ends and secure with a piece of bar stock. After drilling, either bolt or rivet all parts, replacing one of the handles. For greater rigidity, I took apart a screen-door brace and attached the wires as shown in the illustration.—*Robert Burgett, Hamilton, Ohio.*

brush length. I removed the lead and rubbed it on sandpaper until it fitted freely in the brush holder.—*Stephen Winczuk, Santa Monica, Calif.*



substitute a ratchet wrench for the T handle (right) if you silver-solder a $\frac{1}{4}$ " square-drive socket to the top of the tap. This also permits use of socket extensions when you must reach into tight spots.—*Richard C. Collins, Westfield, N. J.*

Heavy-Duty Battery Charger

New silicon rectifiers teamed with a toy-train transformer also give variable-voltage DC for running DC motors, plating, or anodizing

By Henry A. Stockert

HERE'S a rectifier unit you can build that will not only charge your car or boat battery faster than the usual home-type charger, but will also serve as a versatile source of DC for your workshop.

You wind up with a little "black box" that can deliver up to 10 amps DC and safely handle an AC input of up to 70 volts. It uses the new peanut-size silicon rectifiers. These are more efficient than the selenium rectifiers ordinarily used in home chargers and they don't lose their efficiency with age.

In addition to the unit you build, you'll need a source of low-voltage AC. Toy-train transformers are ideal. They're safe, having passed the rigorous Underwriters' Laboratory tests. Voltage output is variable, allowing you to control charging rate, current in a plating bath, or speed of a small DC motor.

Most other parts are available through

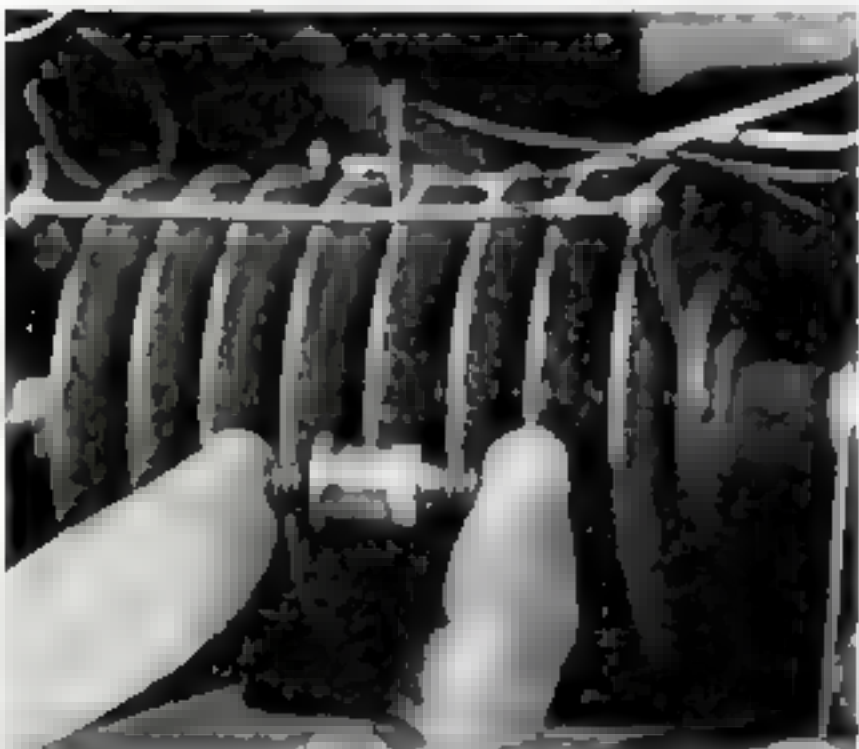
any electronics-supply house. The four rectifiers can be bought from the manufacturer, Standard Rectifier Corp., 620 East Dyer Road, Santa Ana, Calif., for approximately \$15. They are 1N1450's. The Bakelite case measures 3½" by 6½" by 2". A plastic-cased Shurite 0-10-amp direct-current meter shows you how much current you're using. You'll also need a 10-amp fuse and holder, some #14 flexible rubber-covered 110-volt wire, and a few small parts.

Lay out the front panel (this is actually the bottom of the plastic box) as shown, and mount the meter, fuse holder, and output jacks. Cut two plates from ⅛" aluminum to the exact size of your box and drill four corner holes in each with a #38 drill to match the tapped holes in the box. Slice one of the plates in two, using a saw that makes a cut at least 1/16" wide. Drill and tap the four rectifier mounting holes. Remove all burrs from these holes, as the rectifiers must seat snugly to transfer their heat properly to the cooling plates. The other two holes are drilled a little oversize to allow fitting of the plates.

Use #14 wire to do the wiring. Screw in the rectifiers and tighten them without putting stress on their ceramic bodies. Slip ⅛" washers over the ends of the two rectifiers on the large plate and position the small plates over them. After making sure that you have an even space between the small plates, tighten them in place with two cable clamps and two ⅛"-20 nuts.

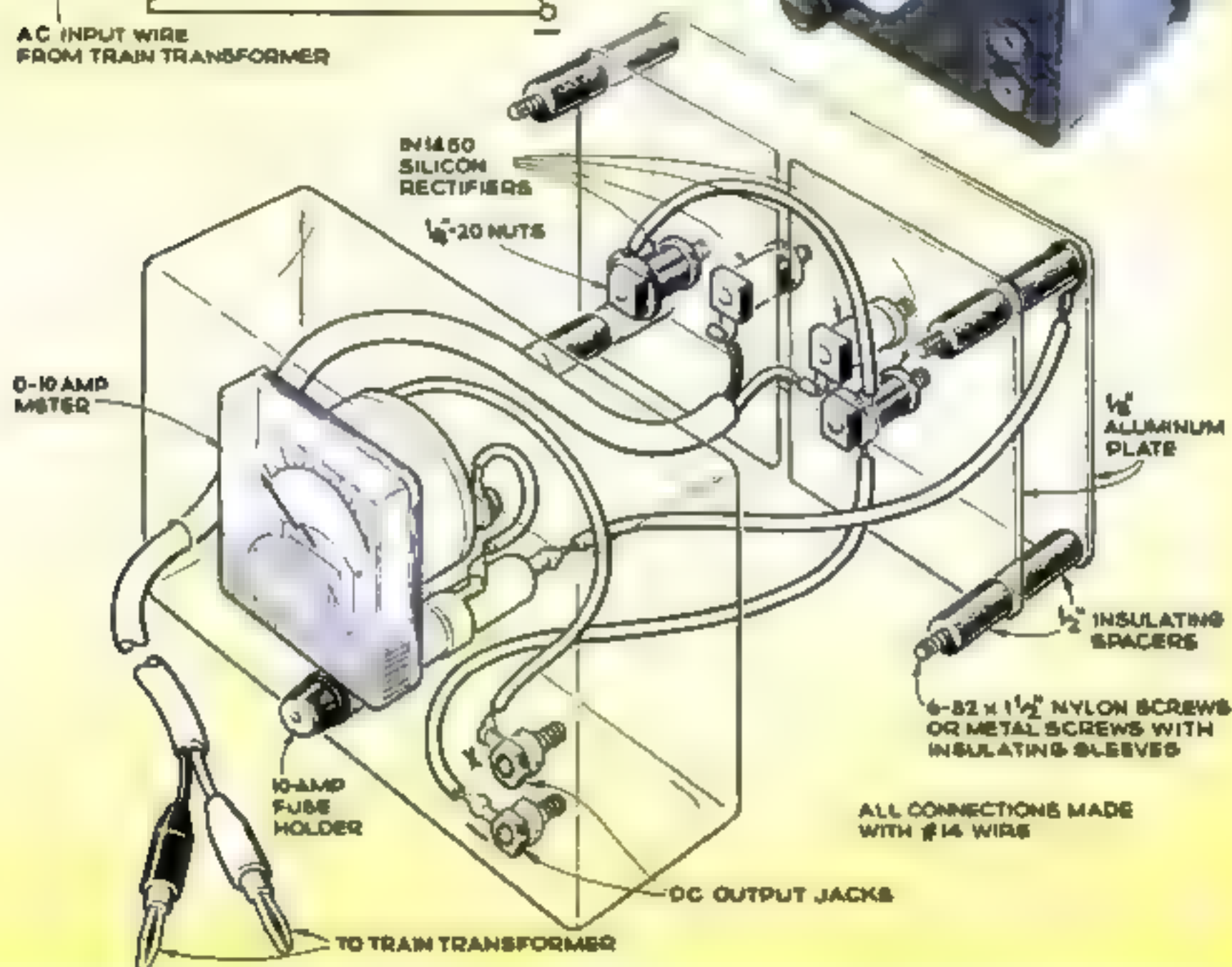
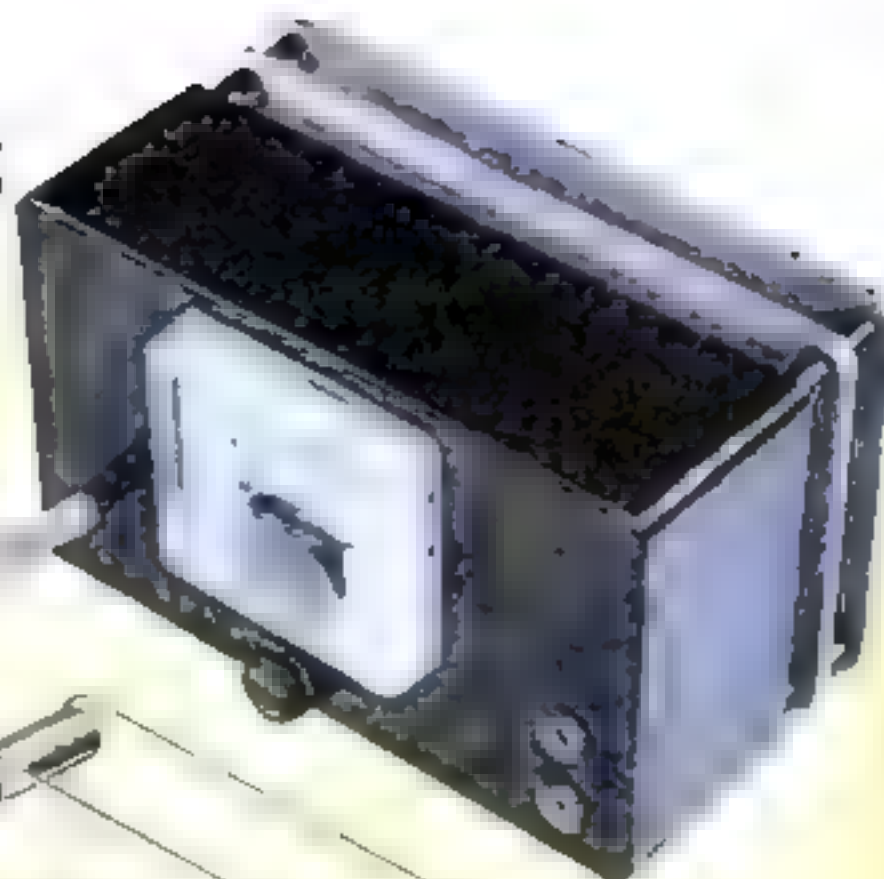
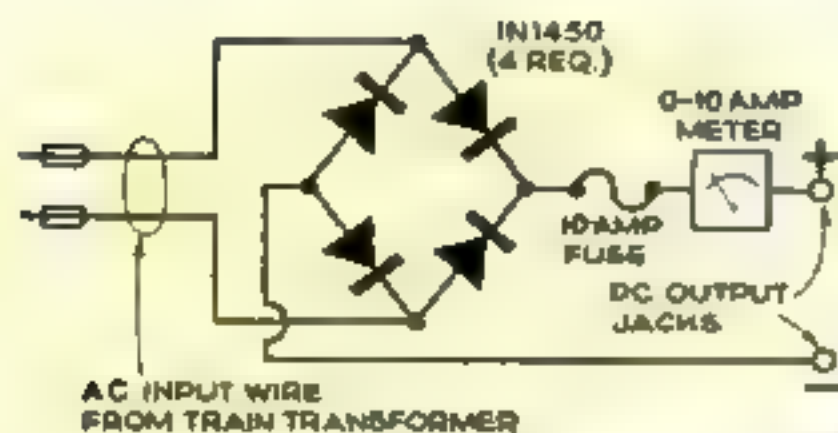
Four No. 6-32-by-1½" nylon screws and four additional ⅛" spacers secure the plates to the box. The three plates must be electrically insulated from each other; if you can't get nylon screws you'll have to drill larger holes in the aluminum and insulate regular screws with electrician's spaghetti and fiber washers. If you have an ohmmeter, you can test the plates for isolation after assembly. Remember that you're working with rectifiers; you may find a "short" between the back and front plates. This should disappear if you reverse your ohmmeter test leads.

To insure that you don't damage the rectifiers, you should slowly increase the load to 10 amps the first time you try it, and then



Tiny silicon rectifier used for project has less internal resistance and can handle more current at higher voltage than the large selenium rectifier that is shown behind it.

... with Extras



place a drop of water on the screw end of the rectifiers. The water should slowly evaporate. Boiling of the drop is a sign that the rectifier is above 212 degrees—and could be permanently damaged.

Charging a weak battery is a typical use for this unit. Connect the black box to the variable output of the train transformer. Run test leads made from the #14 wire (terminated in electrical clips) to the battery. Connect the positive lead from the box to the plus post of the battery, negative to negative. Plug in the lead from the trans-

former and slowly raise the voltage until the desired charging rate is indicated on the meter. Five amps will bring up the battery overnight, although you may choose any rate within the capacity of the unit and the transformer.

The little black box is also handy as a workbench source of DC for work on your car's electrical equipment. Always start with the voltage control low and watch the meter as you raise it so that you don't exceed the rated current of the part you are working on, or of the power supply.

Watch Where You Plant That Tree

By John Burroughs

PROPERLY planted trees and shrubs are a growing investment. But put the wrong one in the wrong place and you may be planting hundreds of dollars of grief.

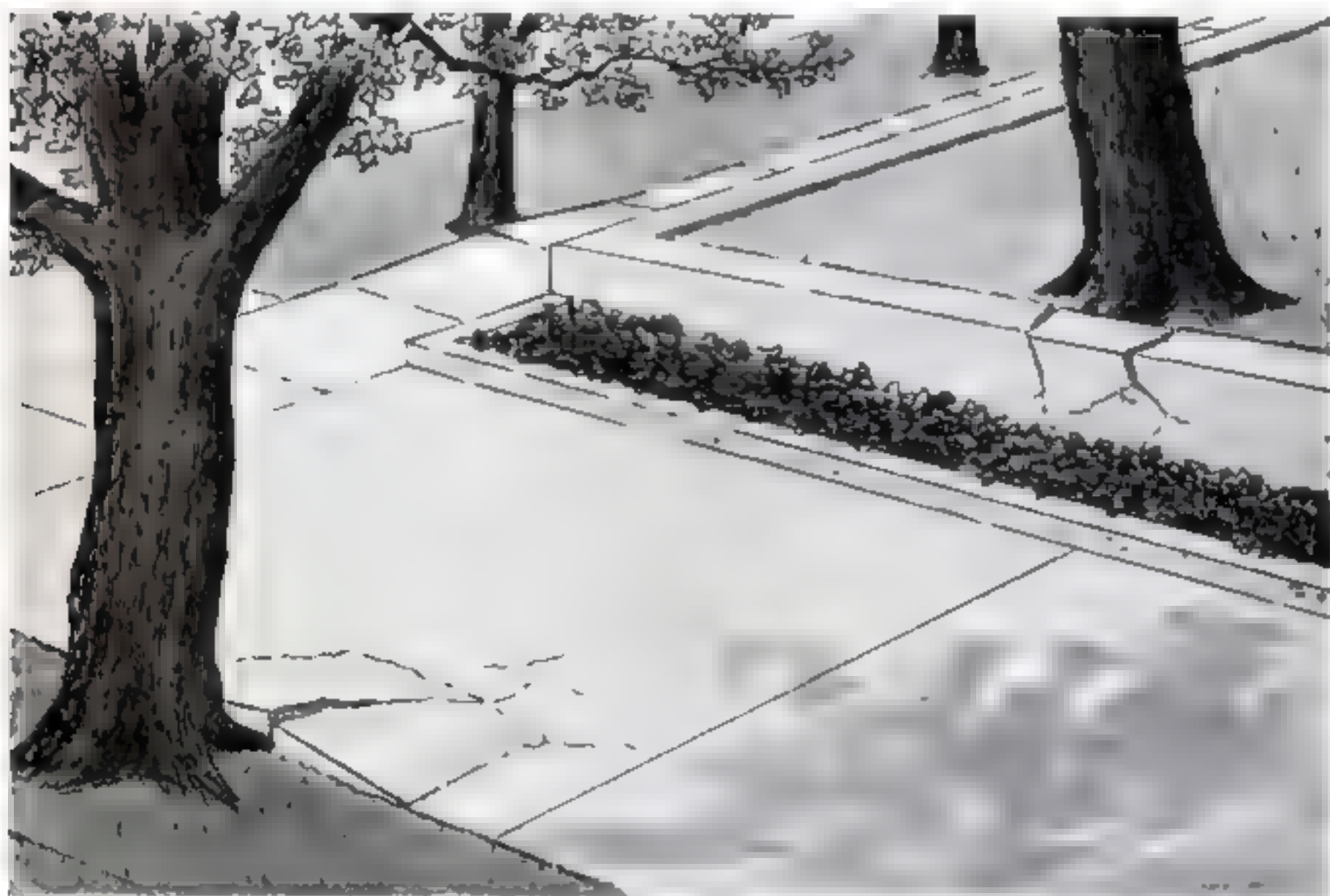
Consider the cost of repairing walls, walks, and driveways cracked by roots from a too-close tree. Or patching up gutters damaged by low-hanging branches. Or replacing root-clogged sewer drains. Or even reroofing, if a hurricane fells a tree with shallow roots.

These are big-money problems. There are smaller ones, too. A large tree growing against your house can harm your chimney draft. It can ruin paint on siding and make

it difficult to repaint. It can tangle with power lines. Wide branches and above-ground roots can ruin a smooth lawn.

It pays, then, to give some thought to how the tree you plant now will look 5, 10, or 20 years from now. Large, fast-growing trees should never be planted right next to the house. Some day you may want to add a room or porch, so don't plunk a monster in the way. Keep plantings a safe distance from all concrete work.

What's a safe distance? Even a small bush can deceive you by growing into a scraggly giant. Gardening handbooks list the rate of growth and approximate size at maturity for all plantings. The minute you take to look them up may save you a pot of money.



Spreading tree roots exert tremendous pressures. If not kept well away, they can bulge and crack garden walls, heave walks and driveways, smash septic tanks, and have even been

known to damage a house foundation. Roots are especially a problem where earth has been excavated away below their level, allowing them to project sideways against an obstruction.



NEW

10 YEARS LATER



Don't be fooled by the size of young trees and bushes. They look fine when new, as above, but can eventually overgrow a house, as at right, obscuring light and view, and creating a shaggy, unkempt appearance. Use only low-growing shrubs along a foundation wall.



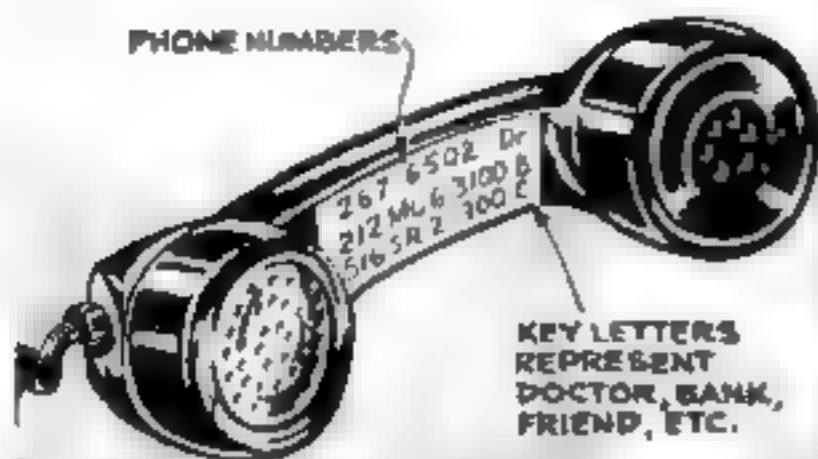
Don't plant big trees in or near a garden. Their spreading roots send up hungry sprouts that can kill off weaker plants and flowers unless you work constantly to yank them out.



Overhanging branches clog roof gutters with leaves and twigs, forcing rain water to back up into house walls. Result: serious damage. Excessive moisture can also rot wood shingles.

Short Cuts and Tips

FROM PS READERS



No more wrong numbers

Phone numbers may be hard to remember with the new all-number system. I write my most-used numbers on a strip of masking tape stuck to the underside of the hand-grip. It's out of sight except when needed.
—Walter Walstad, Flint, Mich.



Don't pierce your pictures

Hold prints on your easel—without marring the edges—by tipping one corner between two thumbtacks. Don't press the heads tight and you'll be able to reposition the photo for working different areas.
—Wayne Floyd, Fayetteville, Tenn.



Car radio for less than \$10

Do you do most of your driving within range of at least one powerful transmitter? If so, you don't need a costly car radio. Try my \$10 rig: a cheap two-transistor portable held on the steering column with rubber bands (a sponge pad absorbs vibra-

tion). To beef up performance, I plugged a 6" speaker into the earphone jack, and attached the lead from a \$2 auto antenna to the ungrounded lead of the built-in loop-stick antenna. To locate the right one, I tried various tuning-condenser leads until the volume of a local station boomed.—Don Mowrer, Phoenix, Ariz.

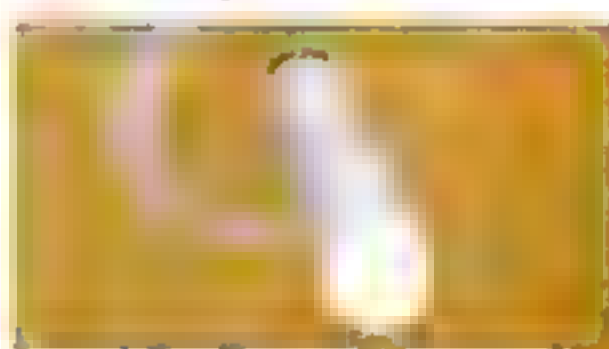


you get lots more from **L&M**

more body
in the blend

more flavor
in the smoke

more taste
through the filter



It's the rich-flavor leaf among L&M's choice tobaccos that makes every puff heartier—for full pleasure. L&M has more of this longer-aged, extra-cured leaf than even some unfiltered cigarettes. And with L&M's modern filter—the Miracle Tip—only pure white touches your lips. L&M, in pack or box—the filter cigarette for people who really like to smoke.



Now you can paint your house in color and be sure it will last . . . with new "Dutch Boy" Latex House Paint

Now there's a new kind of paint that ends all the old problems of conventional colored paints. It's "Dutch Boy" Latex House Paint. Use it and your house will stay looking bright and fresh for years. Made with "Dutch Boy's" own acrylic resins, tests have shown it to be outstandingly resistant to sunlight and oxidization. In fact, this new paint retains its color so well you can come back and touch it up years afterwards, and not see the difference. When it's time for a new paint job, you'll only have to repaint the weathered side. Keep the same color and you may never have to paint your whole house at one time again!

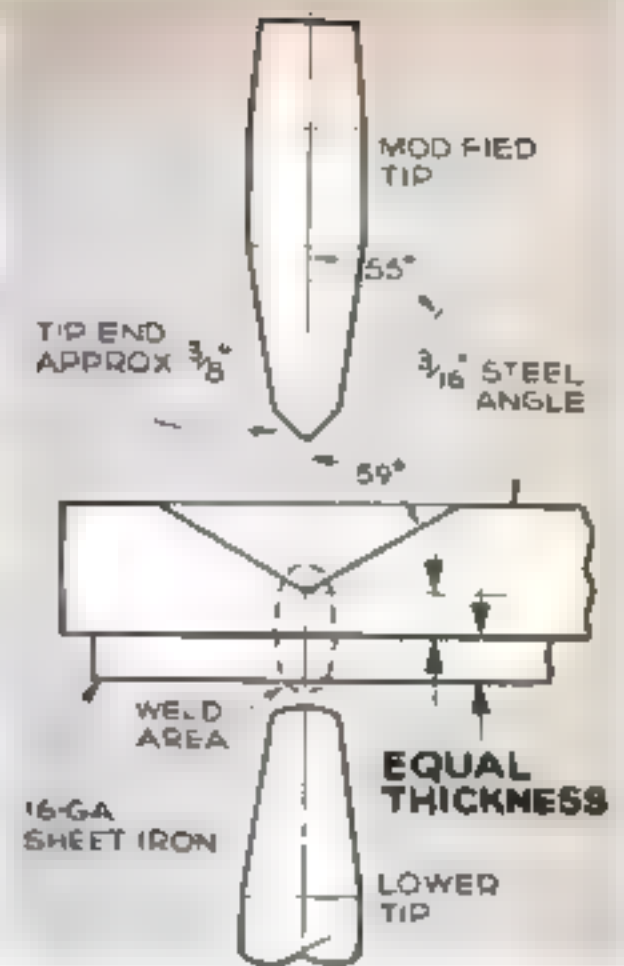
"Dutch Boy" Latex House Paint is probably the most convenient paint ever developed for the weekend painter. You don't have to wait for ideal weather. Use it right after a rainstorm if you like. And you can stop and start anywhere. Lap marks won't show.

It's easier to use, too. "Dutch Boy" Latex House Paint flows off the brush, without paint drag. And this one paint is all you need for almost any surface—wood, stucco, brick and even composition shingles.

More advantages: Brushes and equipment clean up with just soap and water. And you can eliminate most of the blistering and peeling problems that used to be caused by trapped interior moisture. "Dutch Boy" Latex House Paint breathes—allowing moisture to escape, yet sealing out the weather.

If you'd like to find out more about this remarkable paint, check with your nearest "Dutch Boy" dealer, listed in the Yellow Pages. Or write for informative free booklet to: NATIONAL LEAD COMPANY, General Offices, 111 Broadway, New York 6, N. Y.

Dutch Boy
LATEX HOUSE PAINT®



Spot-Welding the Thick and Thin

SPOT-WELDING two sheets of metal of widely different thicknesses has always been difficult; it's almost impossible to get the right amount of heat for both. But I've found a way to do it—drill out the weld area of the thicker sheet until it equals the thickness of the second or thinner sheet of material.

The method has given excellent results in my shop. It takes far less time than drilling for rivets or bolts, and I wind up with a stronger, neater, and more professional piece of work.

As an example, here's how the method can be used to spot-weld $\frac{3}{16}$ " steel angle to 16-gauge sheet iron.

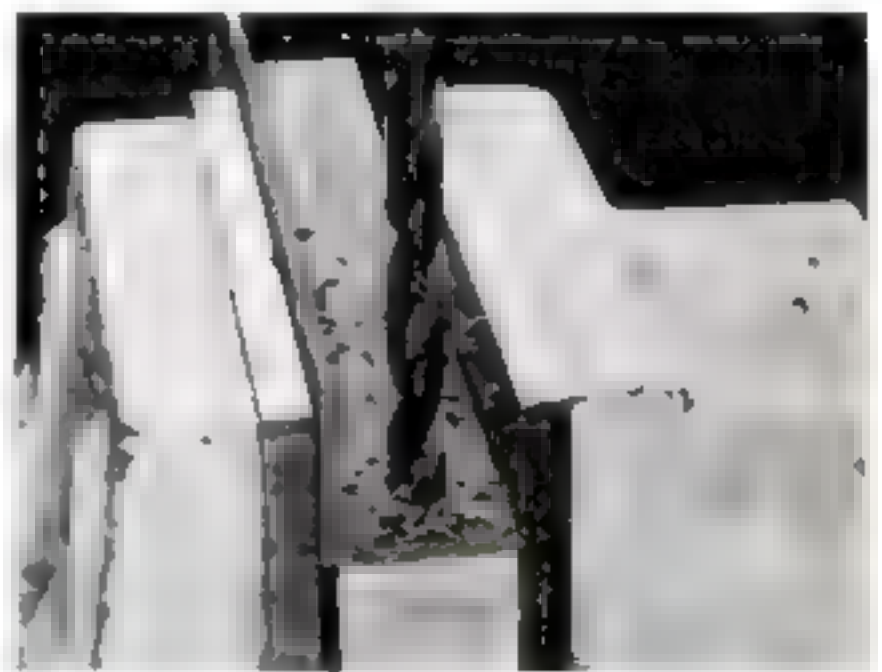
Remove one of the welder tips, chuck it in a lathe, and turn the *end* of the tip to an angle slightly less than the angle of any common steel drill bit—here, about 55 degrees as against 59.

Next, take the thick material and locate and mark (with soapstone or center punch) the locations for the welds. For the $\frac{3}{8}$ " tip here, a $\frac{1}{8}$ " drill can be used to drill the

thick material until the portion under the drill point is the same thickness as the thin material. For joining 16-gauge sheet iron to $\frac{3}{16}$ " steel angle, the drill should go $\frac{3}{8}$ " deep. This leaves $\frac{1}{16}$ ", about the same thickness as the sheet iron.

Clamp the work together, place the modified tip snugly into the drilled recess of the thick material, and apply the spot-welder clamping pressure to the work. Complete the welding cycle to suit the thicknesses of the materials.

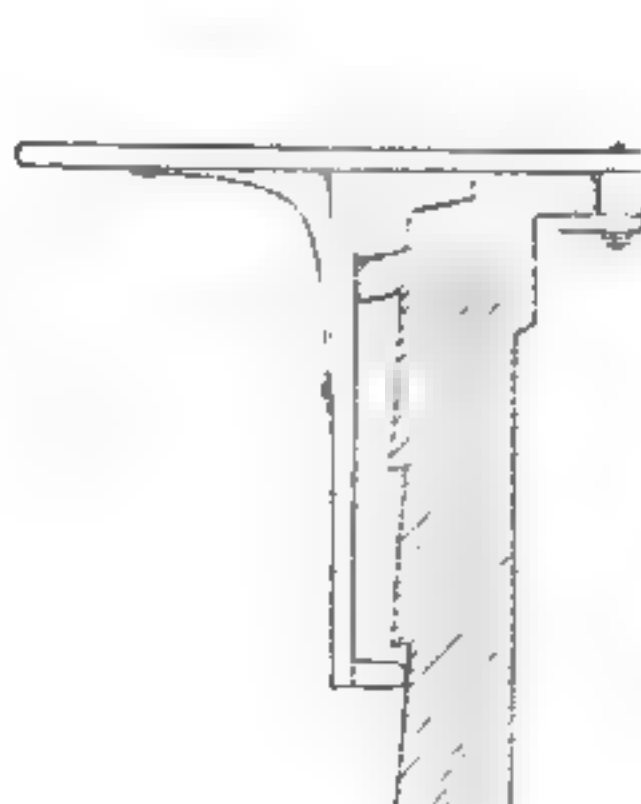
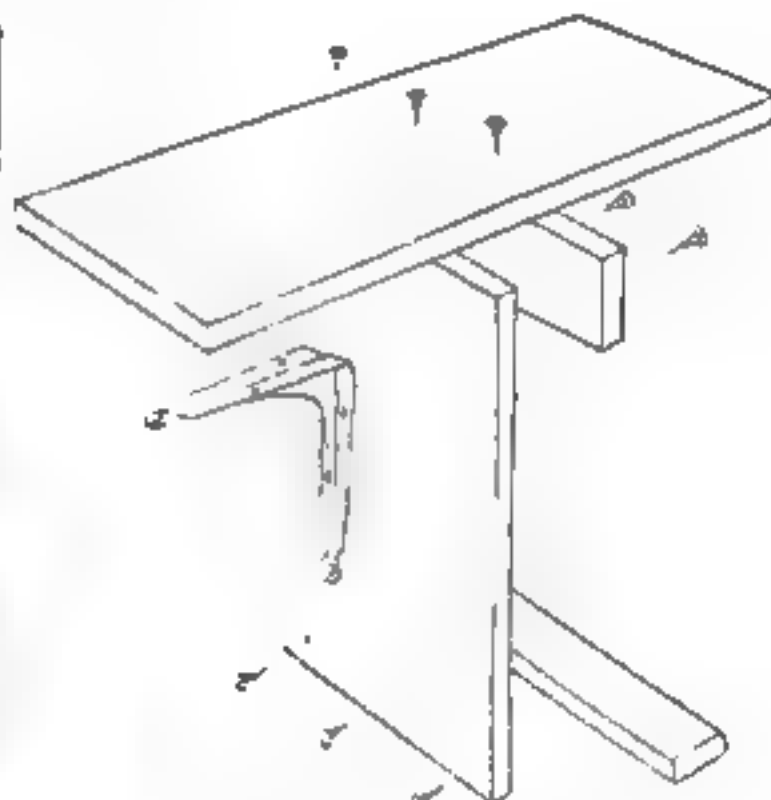
The cycle required will be slightly longer than for welding two pieces of the thin material. This is because the thicker material still drains off heat.—*D. R. Dickinson, Collins Bay, Ont*

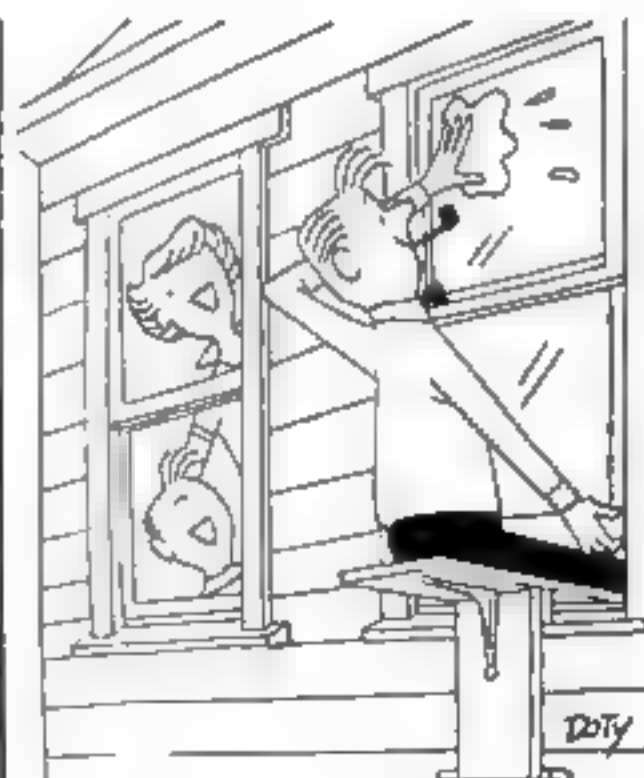
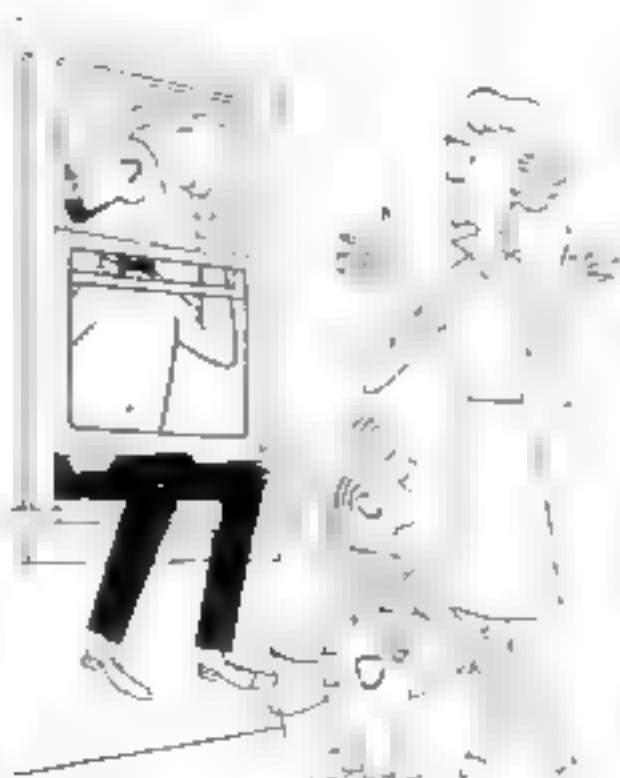
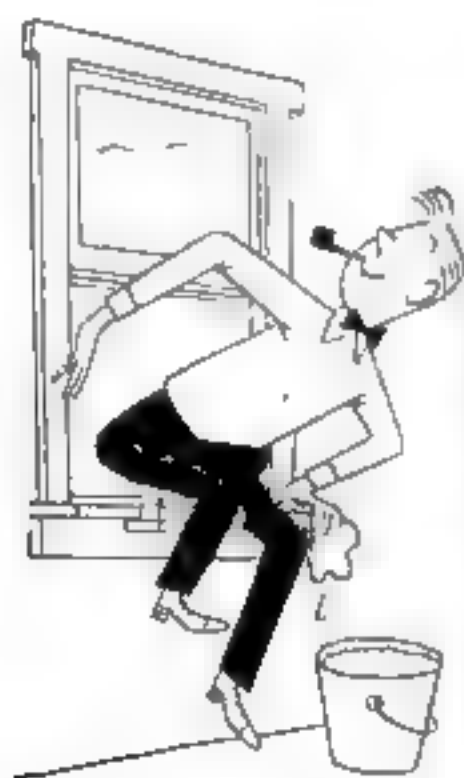
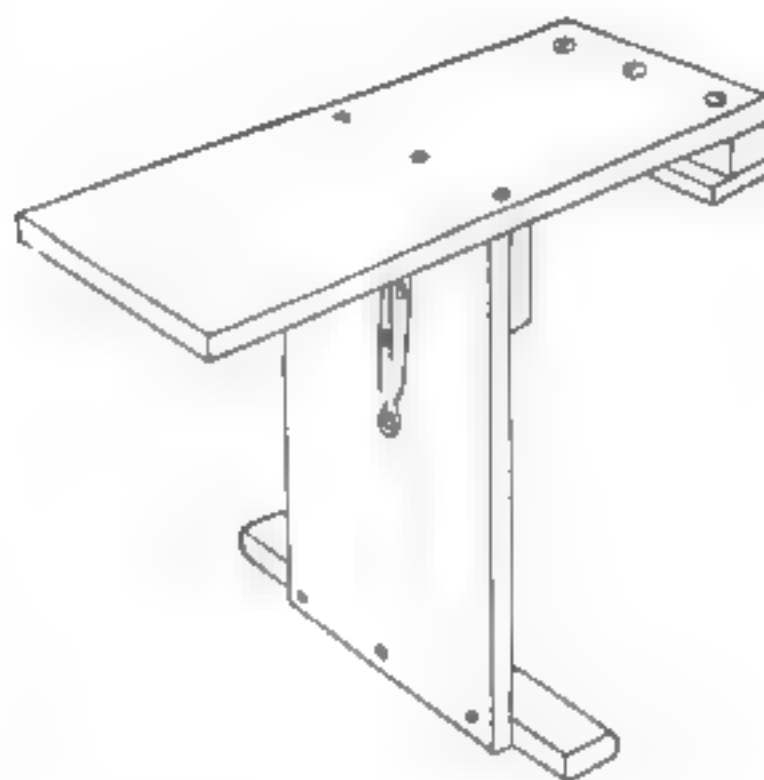
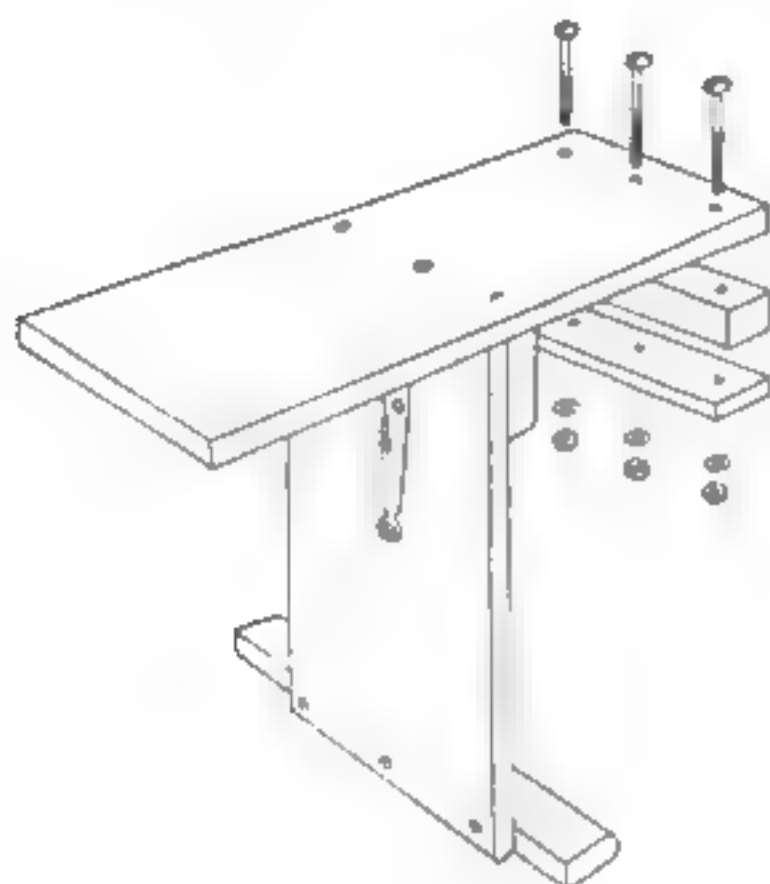
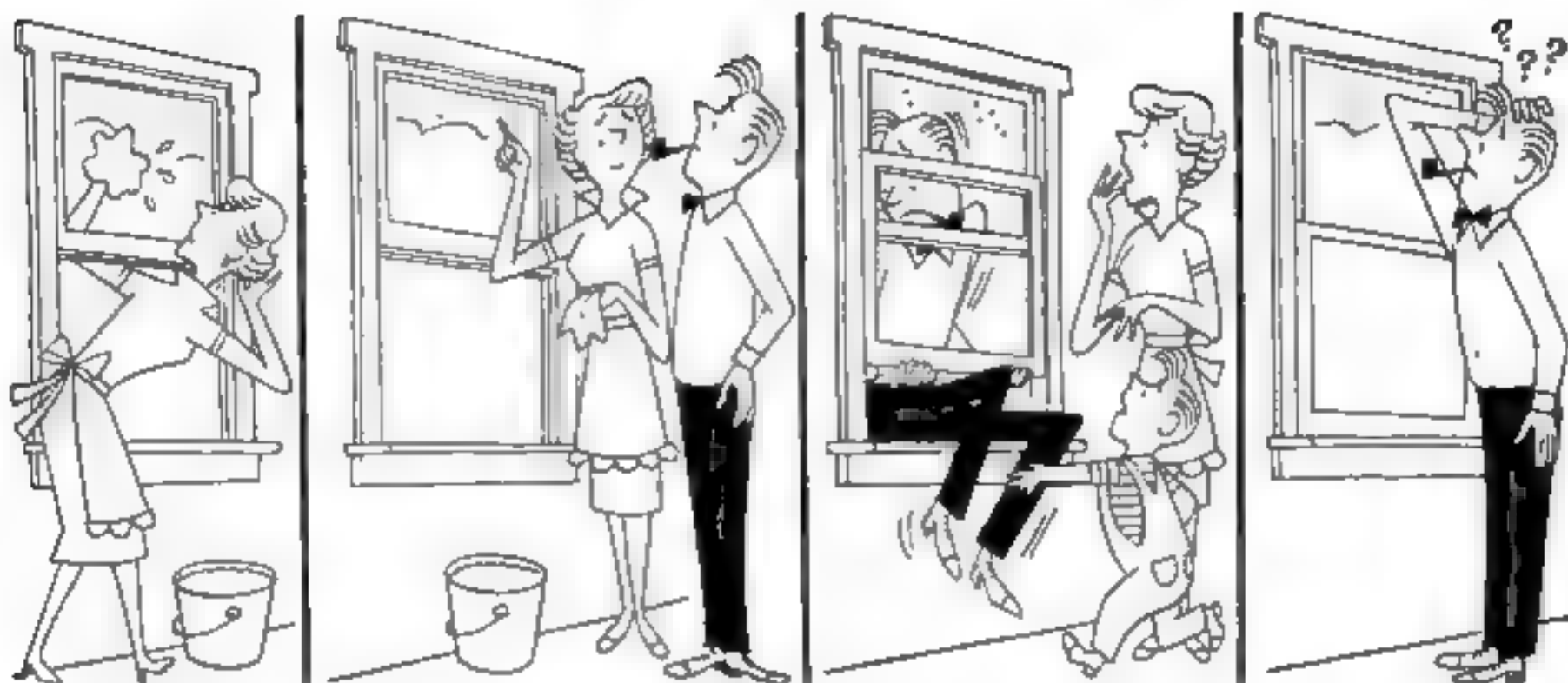


Here's the secret: Drilling out weld area of the thicker sheet lets approximately same degree of heat do the welding job on both pieces.

Wordless Workshop

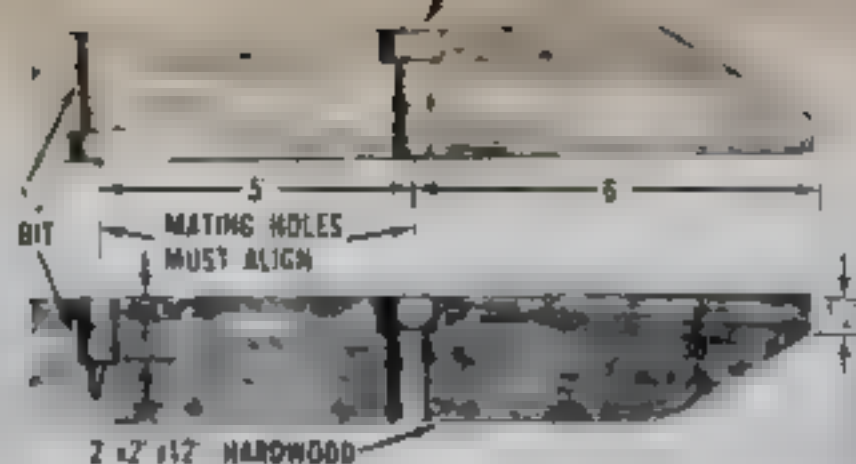
By Roy Doty
and Lawrence W. Smith







Parts for one clamp: hardwood jaws (with drilling pattern indicated); 36" threaded rod, cut in half; octagonal handles; nuts and washers; two-tube epoxy—and cleaning fluid to degrease the rods and nuts for good glue bond.



Cutaway of both jaws show how to drill for rod and nuts. Bore three recesses first. Two in upper jaw are for fixed nuts; nut turns freely in lower jaw recess. Drill three $\frac{1}{2}$ " holes through blocks. Use a stop gauge on the fourth.

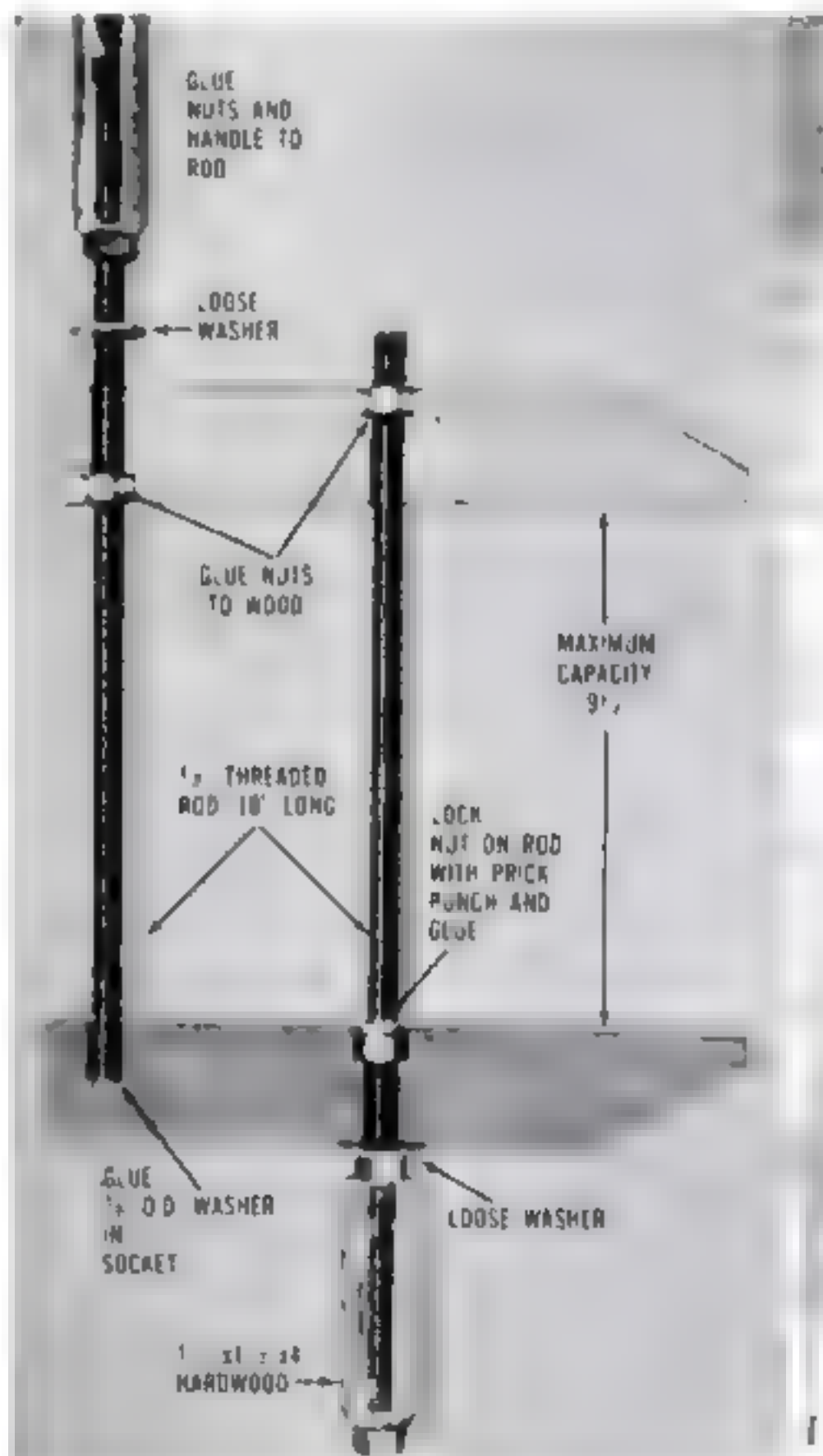
Hardwood Hand Screws: \$3 a Pair

EVER wish you had all the hand screws you need? Now you can make them—for a fraction of what they cost at the store. No threading or tapping is involved. Instead, you use two pieces of threaded rod and seven hex nuts. The secret lies in the use of epoxy cement for assembly. To fasten nuts on the rod, dab on epoxy and twist the nut back and forth to work the cement into the threads.

The dimensions shown are fine for general clamping. You can increase or decrease throat depth by using longer or shorter hardwood jaws, spacing the rods proportionately. But don't use rod under $\frac{1}{2}$ " in diameter. It has too many threads per inch for quick action. Jaws may be of any strong, resilient hardwood.

These hand screws lack one feature of commercial types: You can't adjust the jaws out of parallel. Actually, this can be an advantage—as you know, if you've ever tried to apply even pressure with fully adjustable jaws. To clamp work where the outer faces aren't parallel, you'll have to slip in a compensating wedge.

The total cost varies with the price of the hardwood. If you have usable scraps in the shop, the cost per clamp will be just over a buck.—*J. Ramsey.*



When handles are attached, slip right-hand rod through lower jaw and run third nut on to set in recess. Don't cinch too tight before gluing; it must turn freely, even if wood expands. After all epoxy sets, screw rods into top jaw.

"So there I was
with my trusty..."



Lucky fisherman: compact car . . . compact sailfish . . . new compact Sea-Horse motor.

NEW JOHNSON COMPACTS

Lighter...leaner...same famous Sea-Horse dependability

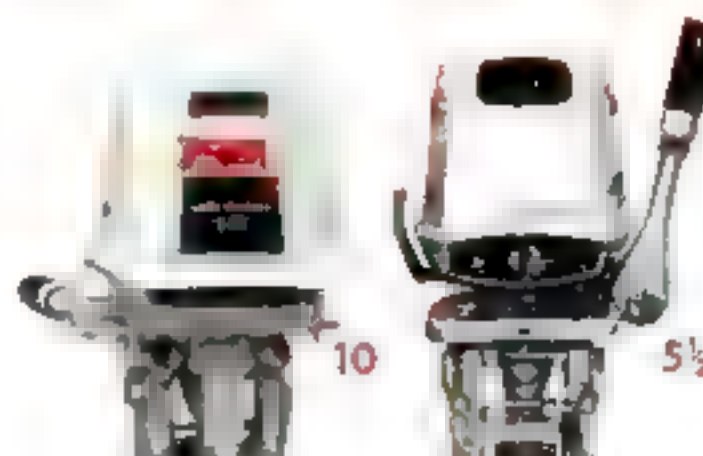
Smaller, sleeker, slimmer and trimmer. It's a '62 Johnson Compact! Designed for function, not for flash. Shown above is the 18 hp model. Below and to the right are the 10 and 5½.

And dependability is their middle name. A cushion hub prop that protects against stump bumping. Thermostatic cooling for smoother any-weather performance. Add a super silencing system, full gearshift, plus corrosion proofing and you've got the best fishing news this side of a bass bed.

Your Johnson dealer's in the Yellow Pages. '62 Sea-Horse motors include: Electramatic 75's and 40's; a budget-bomb 28; and a 3 that thinks it's a 5½. Send for free '62 catalog.

Johnson Motors, 1295 Pershing Rd., Waukegan, Ill. Division of Outboard Marine Corp.

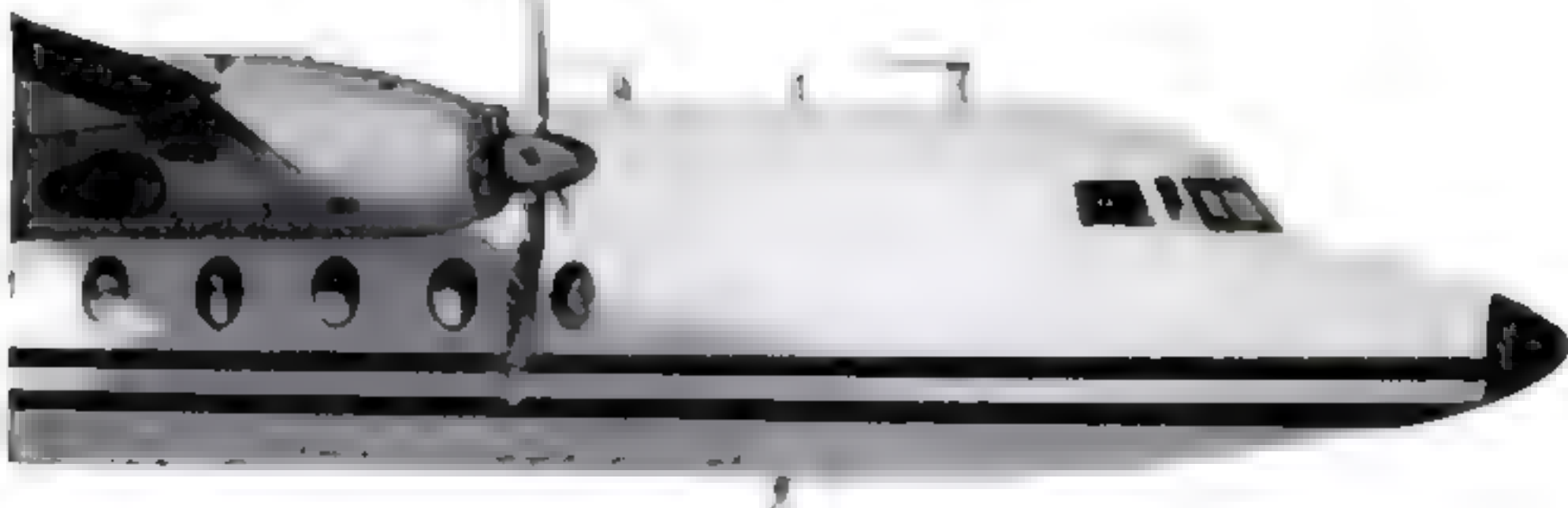
Well over two million quiet Sea-Horse motors prove **JOHNSON DEPENDability**





Win your own private airliner and crew for 14 days-plus \$5,000

Enter the Champion Spark Plug Vacation-of-a-Lifetime contest!



Fly anywhere you want in North America! Take along your family and friends—up to 12 people in all! \$5,000 cash to spend as you like! We pay all taxes on this prize. Nothing to buy! Easy to enter!

Here's your opportunity of a lifetime to live like a king and travel like a maharajah for 14 glorious days!

The whole continent—from California to Maine, from Alaska to Mexico—can be your playground! A luxurious airliner and crew are yours. Fly anywhere you want, any time you like!

Take along your family and friends (up to 12 people) if you wish.

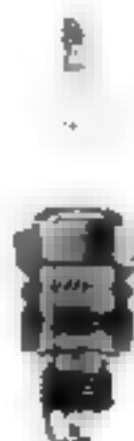
Spend the \$5,000 any way you want. Or, put it in the bank. You don't have to worry about the taxes. Champion pays them for you—just as it pays for the crew and all expenses of your airliner!

And there are 1,242 other prizes—new cars . . . color TV sets . . . movie cameras!

It's easy to win! You don't have to buy anything to enter. Just go to your favorite

service station, car dealer or garage. Ask for a free spark plug check and Champion entry blank. It gives you complete contest rules. (You just complete a jingle . . . and the blank gives you plenty of hints!)

Contest opens April 16—closes May 27. Winners will be notified about July 31. Trip can be taken any time during the next 12 months. Get your free spark plug check and entry blank *today!*



**CHAMPION SPARK PLUG
COMPANY • TOLEDO 1, OHIO**

Gus



Tunes In on Trouble

AS STAN HICKS flipped the channel switch, the speaker in the cab of the Model Garage wrecker came boisterously to life. "... some fog down here, but bridge traffic's light . . . relay to 2C 6399 . . . called you earlier but . . ."

Gus Wilson reached in and snapped it off. "Sounds like a doggone party line," he said to his assistant. "Expect me to listen to this tripe all the time I'm on the road?"

Stan looked pained. "Gosh no, just five minutes every hour on the hour. If a road call comes in while you're out, I route you by radio. Saves all kinds of time."

Gus snorted. "How far'll it reach?"

"About 20 miles. This Citizens Band VHF is line-of-sight transmission."

"Might as well send smoke signals," grunted Gus as he stalked off. Stan grinned, wriggled out of the wrecker, and switched on the shop transceiver, on which he listened to an appeal for AB blood, a reminder to bring home a pint of cream, and an urgent call for a plumber.

"NO GOOD trying to sell me a new battery, Gus," warned Silas Barnstable. "I got four months left on the guarantee."

Gus smiled at the town's tightest character. "Your old one took a full charge, Silas. Cost you only six bits, 'cause I count on repeat business."

Barnstable's skinny fingers shuddered and froze on the latch of his old coin purse. "What repeat business?"

"Recharging. About every two weeks."

"You just said my battery's good!"

Gus nodded. "That's why I checked your voltage regulator. It cuts out too soon. Points are pitted, and it looks as if you've monkeyed with the springs."

The Adam's apple in Barnstable's scrawny neck bounced. "All right, fix it. But don't try to stick me for a new one."

"You tell him, Silas," boomed a new voice. "Mechanics today never want to fix anything—just put in a new one."

Gus turned to grin at the town's veteran veterinarian, Doc Hockenjoss.

"For that covered wagon you drive, Doc, I'd be lucky to find a new part."

"Start tryin'. My speedometer's got the fidgets—jumps like crazy."

"I'll look at it," promised Gus. "And for you, Silas, I'll install new points and springs and adjust your regulator. Here's a list of what it may need and the time costs."

Barnstable glared at the figures. "How much is a new one?"

Gus told him.

"Huh! Beats gamblin' on what might or mightn't have to be done, at your rates," grumbled Silas. "Put a new one in."

He shambled out, dropping the slip Gus had given him. Doc picked it up.

"Hey! You sure outbluffed him."

"Outbluffed nothing," said Gus indignantly. "Those are honest figures. On a time basis, fussing with a complicated unit costs more than I like to charge. Same time, I can't afford to guarantee it unless I do a complete overhaul."

Doc lit his pipe. "You used to rebuild generators, starters, and fuel pumps."

"There were fewer cars around," said Gus. "I had more time, and could charge less. New parts took longer to get. To-

.....

Gus almost broke his wrist snatching up the mike. "This is 2C 7708," he said. "What's going on?"

day, rebuild shops make 'em like new. I can guarantee a new or rebuilt unit. If it's defective I get another."

A VACANT spot on the shop floor drew Gus's eyes as he came back into the garage after lunch.

"Hey, where's Mrs. Maybell's car?"

Stan slid out from under a truck. "She got it early to go to the city and then visit her sister across the river. Anyway, it was all ready to go."

"But not road-tested. I like to check out a complete brake overhaul."

"I did, Boss. Four times around the block, and looked over all the line connections afterwards. The pedal felt pretty hard, but I think it'll loosen up. Besides, she was in an awful hurry."

"Hmm . . . Well, thanks," Gus said. "I'm going across the bridge myself to get that engine for Benson's sports car. Find a speedometer-cable housing for Doc yet?"

Stan shook his head. "Two shops told me to try the Smithsonian. Uh, Boss—you won't forget, will you?"

"Forget what?" asked Gus, climbing aboard the wrecker.

"To tune in channel 3 on the hour."

The engine drowned out Gus's reply.

STARTING the 60-mile trip back to the Model Garage with the sports-car engine, Gus spotted a billboard clock that reminded him it was almost four. He switched the two-way to CB channel 3. "... new rig you put on comes in fine . . . heard any of the new . . . priority call for 2G 7708 . . . priority for 2G 7708 . . . come in, 2G 7708 . . ."

Somebody, Gus reflected, wanted that 2G whatever pretty badly—maybe to tell him his mother-in-law was coming for a visit. Gus flicked his eyes to the windshield sticker bearing his call letters.

He was 2G 7708!

He almost broke his wrist snatching up the mike. "This is 2G 7708. What's going on?"

"This is 3R 3711, relaying to 2G 7708. Police ask you to go to west end of the vehicular tunnel, urgent. Please go at

once to west end of vehicular tunnel."

"But I'm headed for the bridge!"

"I'm relaying an urgent police message at the request of your home transmitter. You're needed at the tunnel."

"Okay," said a puzzled Gus.

He turned around, headed south. A mile from the tunnel a siren screamed up behind. The police car passed with an urgent wave-on. Gus followed, through the tollgates and down the left lane of the tunnel, past a long line of cars stopped bumper-to-bumper. The tile walls flicked by at 50 m.p.h. until a red flasher winked ahead.

It was on a tow truck, backed up to a behemoth trailer rig that squatted lopsidedly on a broken axle. But what drew Gus's eyes was the eight-year-old sedan alongside the truck, corking up the second lane.

The sedan was Mrs. Maybell's.

The trooper came over as Gus got down. "That car has locked brakes. The driver says they'd been dragging and she had stopped five times to cool them and the engine. Then she had to brake hard for this tie-up. When she tried to get by, the brakes wouldn't let go.

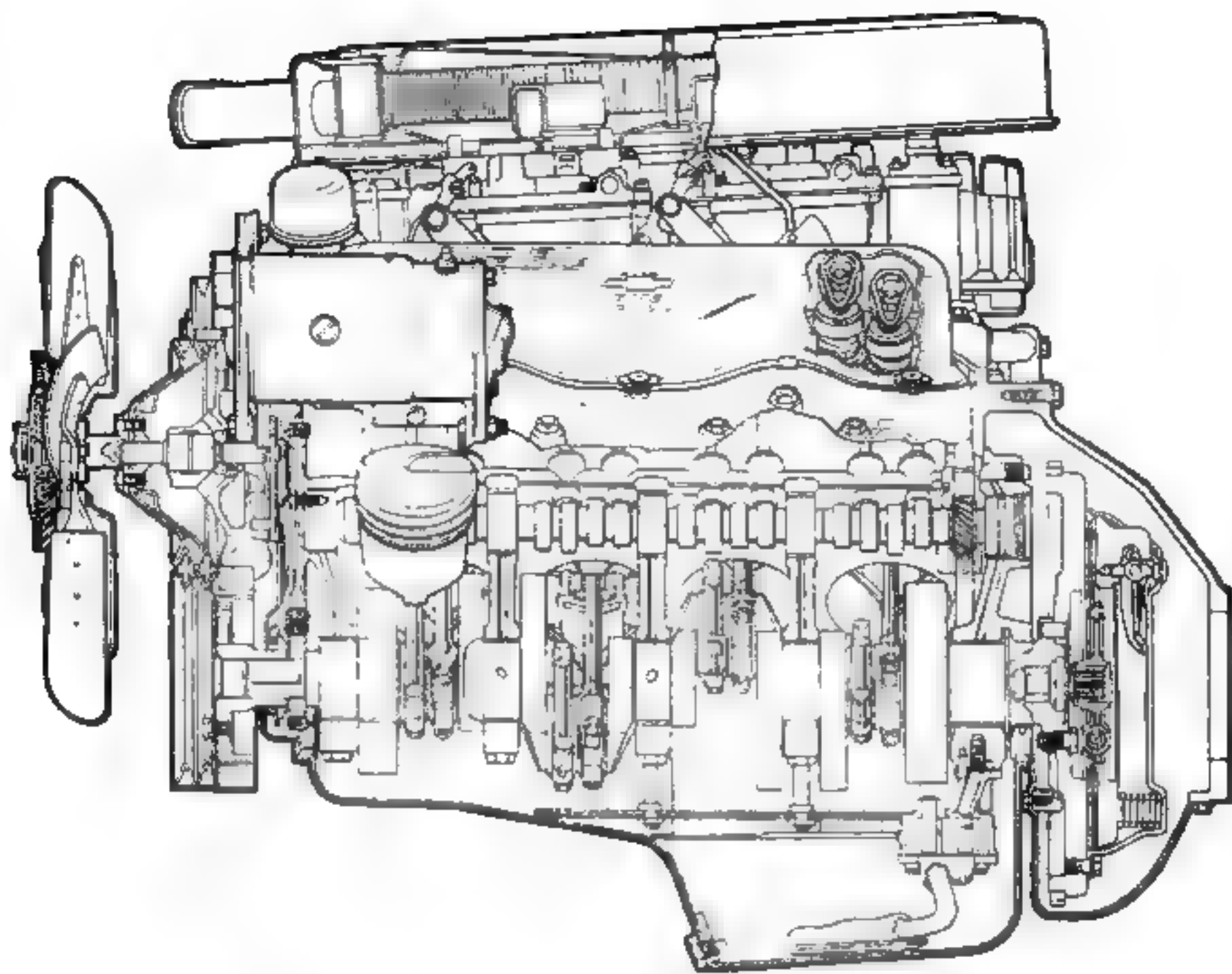
"The car behind couldn't budge her. Our tow truck can't yank her out, even with the front wheels up. She got hysterical, hollered that you'd done something to the brakes. So we called your shop."

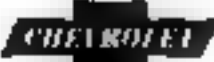
"I'll go see," muttered Gus.

The sickening reek of burned brake lining filled the tunnel. Mrs. Maybell was sobbing on another woman's shoulder. Gus stooped by one wheel. Heat from its brake drum hit him as if from a hot stove.

He climbed inside the car and, wrenching and straining, freed the stuck brake pedal. The wheels remained locked. The pedal stayed very high and hard.

One by one Gus considered and rejected the possible causes. Loose or torn linings? Hardly likely even on a single wheel, right after a brake job, but certainly not on all four wheels at once. Ditto on loose anchor bolts and an obstructed brake line. Weak brake-shoe re-



<div>108</div> <div><i>Chevy 409 V8</i></div>	<div>REMARKS</div> <div><i>Son of a gun!</i></div>
<div>BORE</div> <div><i>4.3125</i></div>	<p>Amazing! This engine, available as an extra-cost option, turns a perfectly normal Chevrolet into something else altogether. It's available as shown with two aluminum four-barrels and a special cam or in a slightly tamer version with one four-barrel and a mere 380 horsepower. If performance is your meat, this engine'll give you just about all the protein a feller could use. Check the chart!</p>
<div>STROKE</div> <div><i>3.50</i></div>	
<div>GROSS HORSEPOWER</div> <div><i>409 @ 6000</i></div>	
<div>GROSS TORQUE (LB. FT.)</div> <div><i>420 @ 4000</i></div>	
<div>COMPRESSION RATIO</div> <div><i>11 to 1</i></div>	
<div>DISPLACEMENT (CU. IN.)</div> <div><i>409</i></div>	
<div></div>	<div>CHEVROLET DIVISION OF GENERAL MOTORS, DETROIT 2, MICHIGAN</div>

turn springs would drag rather than lock, and as for the chances of bad springs on all four wheels . . . Remote. Brake lining too thick? That would have shown up right away, and Stan had given the car a short road test.

Only one component, Gus decided, could be causing the trouble.

He got into the wrecker, tussled it around, backed up to the car and winched up the front end.

Sliding under, he cautiously opened a bleeder valve. With a roar, vapor and

check that. You'll find the new master cylinder there on the bench. I drained it, but thought you'd want to open it."

Doc Hockenjoss walked in as the factory man deftly disassembled the unit. He poked in various gauges, shook his head, and began to fill out a form.

"It's one of those foul-ups nobody can explain," he said. "The bypass port was drilled a thirty-second inch too far back, so the piston cup didn't uncover it on the return stroke and fluid could never get back to the reservoir. Every time the

brakes were applied, a little more fluid was forced into the system. Eventually there was so much it locked the brakes completely."

He tore off a carbon of the form. "We'll pay for everything—the tow, your charge for the repair job, and replacement parts."

"WHAT was that?" asked Doc when the factory man had gone. "The exception that proves what you said about rebuilds?"

"That was no rebuild," returned Gus. "I install new master cylinders. Old ones may have pitted walls. This was a thousand-to-one shot, a defective new one."

"Uh-huh. And my speedometer?"

"Your cable housing had a kink that finally broke through and snagged the cable, making it turn unsteadily. Couldn't get a new one any place, Doc."

Doc's face fell. "Thanks for trying. Sure hate to be without a speedometer."

"You aren't. I soldered a sleeve over the break. It'll run another 20 years."

Doc smiled. "I take it back about you never fixing anything. Say, it's all over town how you popped up in the tunnel to rescue Bessie Maybell."

Gus felt his neck grow warm. "It only happened because of that fool two-way radio Stan talked me into. Like it or not, it sure got me a road job!" ■ ■



boiling fluid spurted out. He let the fury spend itself and tried the wheel. It turned.

On the way back, with the car dangling from the wrecker's hook and Mrs. Maybell sitting stiff and red-eyed beside him, Gus left the CB switch off.

NEXT morning, he led a factory inspector to the Maybell car, up on blocks.

"The new lining we put in is all charred, wheel-cylinder rubbers cooked, all four drums warped so badly they can't be trued," said Gus. "Either we set the master-cylinder push rod too long, or that cylinder you sent was defective."

"We know your reputation," said the inspector. "Hardly seems you'd slip up on leaving free travel in the push rod."

Gus nodded. "We always double-



TAIL DRAGGING?



SCRAPING ON DRIVEWAYS? This common annoyance, the result of soft springing, heavy weight and the longer, lower design of today's cars, is eliminated when you install Monroe Super Load-Leveler® stabilizing units. Gone is the problem of scraping rear bumper or tailpipe on any incline.

SWAYING ON CURVES? Side sway is dangerous, throws passengers from side to side, causes uneven tire wear. Give your car that sure-footed "sports car feel" with Monroe Super Load-Leveler stabilizing units.

"BOTTOMING" ON BUMPS? End this danger with Super Load-Leveler stabilizing units. They prevent jarring jolts that can cause car damage and injury. For a safer, more comfortable ride, have a set installed today where you have your car serviced. Ask about Monroe's 60-day free ride.

LOOK FOR THE YELLOW AND BLUE



MONROE DEMONSTRATOR BARREL



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Home Shop NEWS REPORT

by Sheldon M. Gallager

For quick cleanup, now it's "plastic wool"

A nylon scouring pad said to be tougher than steel wool whisks rust, stains, and grime off shop equipment, whitewall tires, floors, and painted surfaces like that of the boat hull shown here. Called Scotch-brite, the porous, spongelike pads are so strong

they won't shred under hard use. They're sold in hardware and grocery stores by Minnesota Mining & Mfg. Co. for about 25 cents each.



New three-speed radial saw

An unusual new radial-arm saw uses three separately geared spindles to give you a choice of 3,450 r.p.m. for slow jobs like grinding, 5,000 r.p.m. for sawing, and 10,000 r.p.m. for high-speed work like routing. Different spindle sizes permit only the proper accessories to be used at each speed. The husky 10", 2½-hp. Shopmate sells for about \$180

from Portable Electric Tools, 1200 E. State St., Geneva, Ill.

Hiding plywood edges: new hardware to the rescue

Here's another answer to that old problem of edge-joining plywood panels. It's an H-shaped aluminum molding strip that slips over both edges of mating panels to hide the joint, made by Reynolds Metals, Richmond, Va. The decoratively ribbed strips come in three sizes for ¼", ½", and ¾" plywood.

For free—two fresh ideas in modern ceilings

An easy, inexpensive ceiling for a basement playroom or shop can be made with strips of hardboard cut to fit between the joists. They rest on one-by-three cleats nailed to the undersides of the joists to form supporting ledges. No fastening is needed, and the hardboard strips can be removed at any time to get at pipes or wiring. For free instructions, ask for Bulletin A-267 from Masonite Service Bureau, 111 W. Washington St., Chicago 2 . . . Like to build an attractive dropped-ceiling lighting fixture for a dining or other area? Plans for one made of plywood are available free from U.S. Plywood Corp., 55 W. 44th St., NYC

FROM
MILLS ■

GRADED

SPECIFY

■ WESTERN
ASSOCIATION

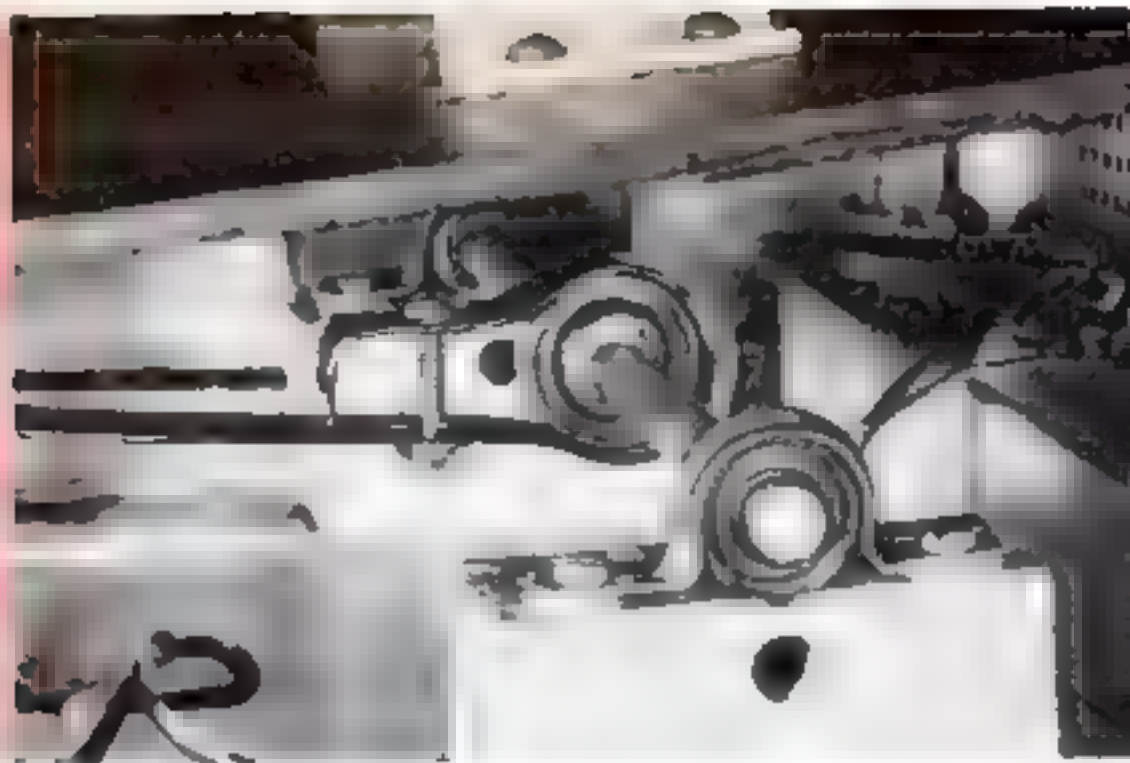
IDEAS FOR VACATION- LAND HOMES



Get This FREE Booklet . . . available now at your building supply dealer's. Here are 10 exciting "second homes" designed by leading architects for your family's complete enjoyment of shore or mountains. Designs are fully illustrated, with floor plans. Complete building plans are available for each home shown. If your dealer is unable to supply you with this booklet, send 10c to Western Pine Association, Dept. S-8, Yeon Building, Portland 4, Oregon. **Western Pine Region Solid Lumber** will give you enduring enjoyment of your vacation home. These remarkable woods provide beauty that fits into nature's mood. They offer strength, durability and easy working qualities in ideal combination.

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...how to make an eccentric without

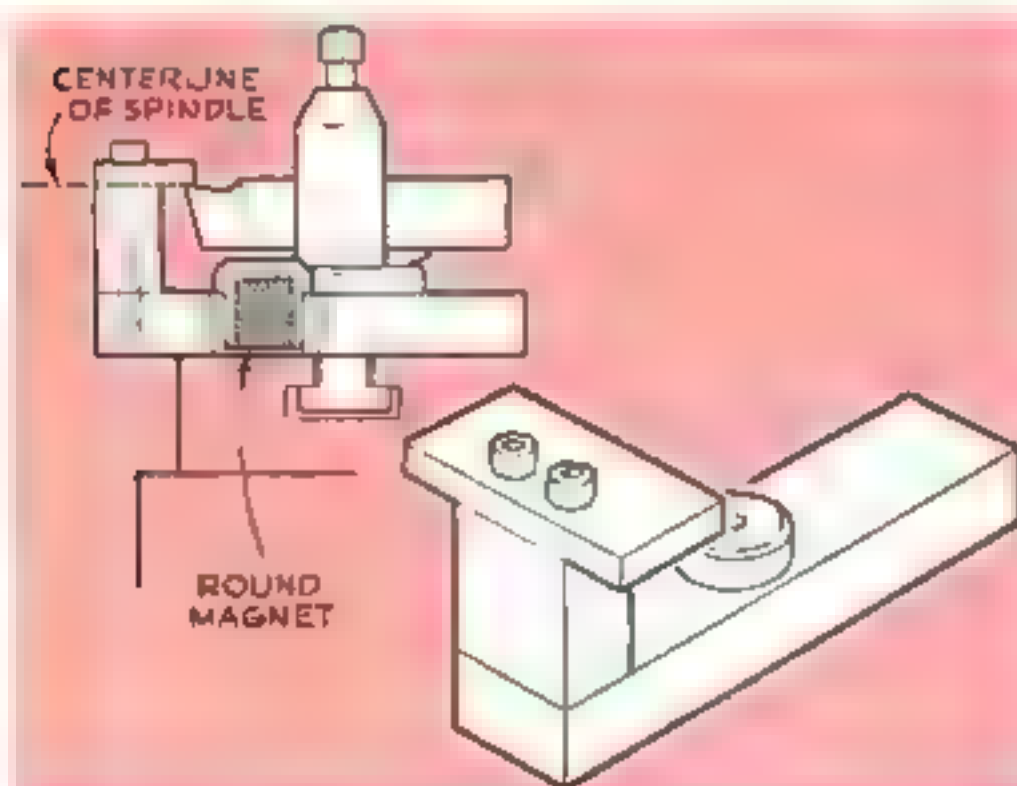
NEEED an eccentric for some device you're building? Here's how you can make one without using machine tools. I devised the technique when I wanted to build a machine to plant seeds for laboratory testing. It has worked an entire season without mechanical failure.

The only parts you'll need are a ball-bearing assembly, shafting, a piece of welding rod, and a scrap of sheet metal. Choose a bearing with an inside diameter enough larger than your shaft to give your eccentric the required throw. The center of the shaft will, of course, have to be offset from the center of the bearing by half the amount of linear motion you want.

Drill a hole that will be a press fit for

the welding rod at the point along the shaft where you want the eccentric. Drill about halfway through the shaft. Press in a short length of welding rod and cut it off so it protrudes about half the amount of the eccentricity. Tin this pin and shaft where it will be in contact with the solder insert.

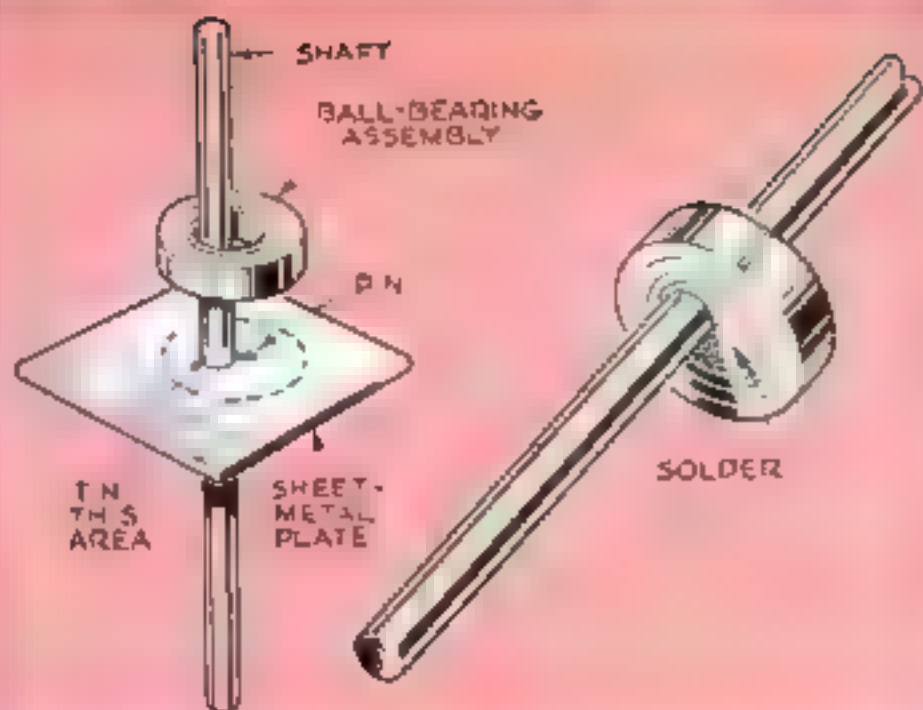
Drill a snug-fitting hole for the shaft through the piece of sheet metal. Slide this plate on the shaft to a point about $\frac{1}{8}$ " to $3/16$ " from the pin. Clamp the shaft upright in a machinist's vise so that the plate is exactly perpendicular to the shaft and rests on the vise jaws. If necessary, use shims between the plate and jaws to obtain exact alignment.



... how to set tool on center

Setting a lathe tool exactly on center is fast and easy with a tool like the one shown here. It is made from flat-ground stock. The tool-setting block is hardened. The underside should be at exact center of the lathe spindle when the gauge is in position on the cross slide. Its ends overhang the spacer block, allowing it to be used on either side of the tool post.

A round magnet, retained in a brass housing pressed into the base, holds the device on the slide while you're adjusting the lathe tool.—*F. Murray, Chicago.*



machine tools

Place the bearing on the plate and position it for the required throw (off-center by half the desired linear travel). Wrap the bearing with a small, wet rag to keep it from overheating. Concentrate the heat from a torch on the shaft about an inch above the bearing. When soldering temperature is reached, the tinned area on the shaft will glisten.

Now start melting bar solder against the hot shaft and allow it to run down in the center of the bearing. Continue to heat the shaft and apply solder till the inside of the bearing is filled. Cool the insert by dripping water on it until you find that all sizzling has stopped.—*John Turner, Cedar Rapids, Iowa.*



... there's a quick alignment test

Of the many ways to test alignment of a tail center with the head spindle on a lathe, I like this one best. You need nothing special and it's quick and easy.

Clamp a small dial test indicator, with its universal attachment, to a faceplate as in the setup above. Bring the indicator contact point to bear on the point of the tail center. As you revolve the head spindle by hand, any alignment error will be detected by the indicator. Correct misalignment by offsetting the tailstock one half the indicated runout.—*H. J. Gerber, Stillwater, Okla.*

▶▶▶ I made a handy scriber from a retractable ball-point pen. After removing the ball point, I substituted a short piercing punch (0.1" shaft diameter) with the point ground to scriber shape. Retracted, the scriber clips to my pocket.—*Federico Strasser, Santiago, Chile.*

... offsetting may enlarge a hole

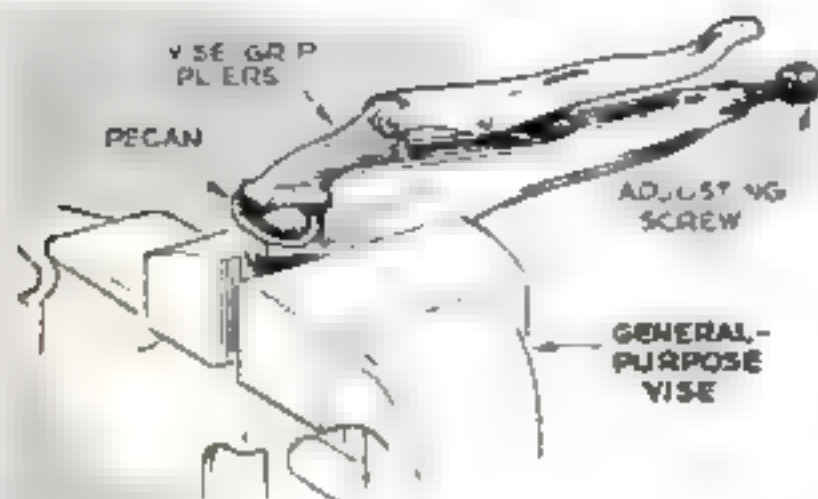
Suppose a hole drilled on the lathe is slightly undersize and the next size bit is just a little too large for the hole that you want. What do you do? Try offsetting the original drill, or a smaller one, in the chuck as at right.

One way of doing this: Place a bent strip of sheet metal between the bit shank and two jaws of the chuck, shifting the bit sideways toward the third jaw. Position the bit so the outer point of one cutting lip is in line with the third jaw. The bit then acts as a boring tool, with this point doing the cutting. Feed the bit slowly and make several passes if necessary.—*Walter E. Burton, Akron, Ohio.*



Short Cuts and Tips

FROM PS READERS



Plier wrench cracks pecans

SEPARATING the meat of a pecan from its shell is tricky without a special cracker. To improvise one, clamp a plier-wrench in a vise, as shown. The adjusting screw lets you snug the jaws on different-size shells.—C. M. Carnes, Jackson, Miss

▶▶▶NEXT time a crack appears just as you are about to apply the final coat of flat wall paint, don't waste time patching and priming. Instead, mix some kitchen flour into a



Flash-guide holder on camera

CEMENT a plastic sleeve—like those found in wallets or supplied with credit cards—to the back of your camera case. It's just right for the data card cut from the carton of flash bulbs you're using.—Ken Patterson, Moose Jaw, Sask.

little of the finish paint, and work this paste into the crack. Wipe the surface and go right ahead with your paint job.—Herbert C. Goda, Dundee, Mich.



My Most Embarrassing Shop Moment

By J. H. Matthews
University City, Mo.

I had just bought a brand-new pair of steel-toe safety shoes and was proudly showing them off to my fellow workers at our machine shop. I was urging the others to obtain the same protective footwear, pointing out

that these new shoes, unlike the ugly, old-fashioned type, had the trim look of black dress Oxfords.

When they pooh-poohed the value of safety shoes, I felt I had to do something dramatic to impress them. I told one of them to take a nearby hand truck loaded with two heavy castings and roll it over my outstretched foot.

My smugness vanished immediately, however, and I let out a howl of pain as the shoe tip collapsed like a paper cup. After hobbling back from the first-aid office with my crushed toes wrapped in bandages, I began to examine the flattened shoe in disgust. No more steel tips for me.

Then I noticed something. The shoes looked exactly like dress Oxfords, all right. In fact, that's just what they were—my real dress Oxfords. I had left the steel-tipped safety shoes back home in my closet.



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Short Cuts and Tips

FROM PS READERS

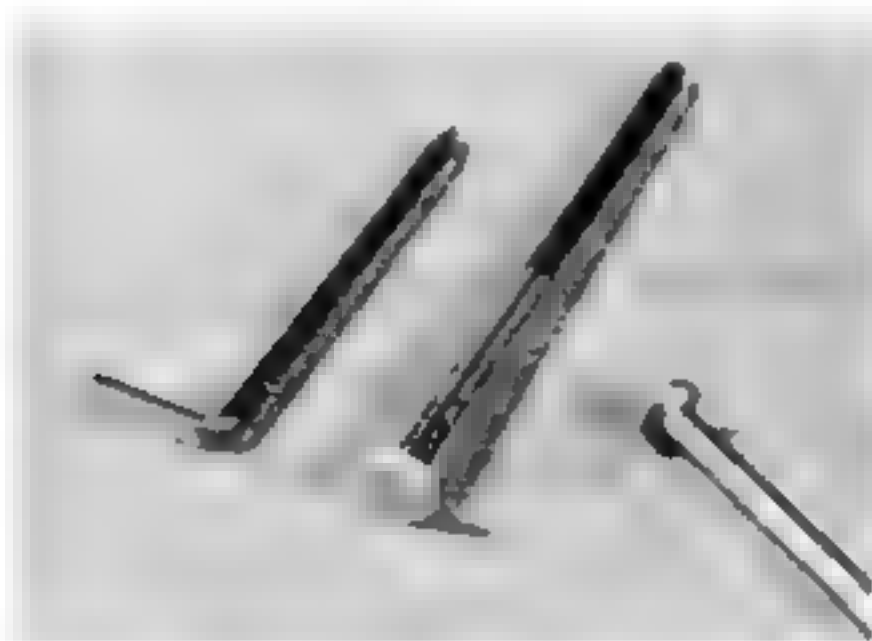
Oil drum on stilts makes barbecue grill

Cut out and hinge most of one side of a 55-gallon oil drum, fit in a grill, and you're ready to play back-yard chef. When you're through, you fold the lid back to shield the grill from rain. The drum itself is rustproofed with a coat of paint. A stovepipe, welded over a hole near the back, carries smoke away. The lower half of the front end is cut out and hinged to help you remove ashes. Metal feet are welded on and anchored to brick piers.—*Wayne Floyd, Fayetteville, Tenn.*



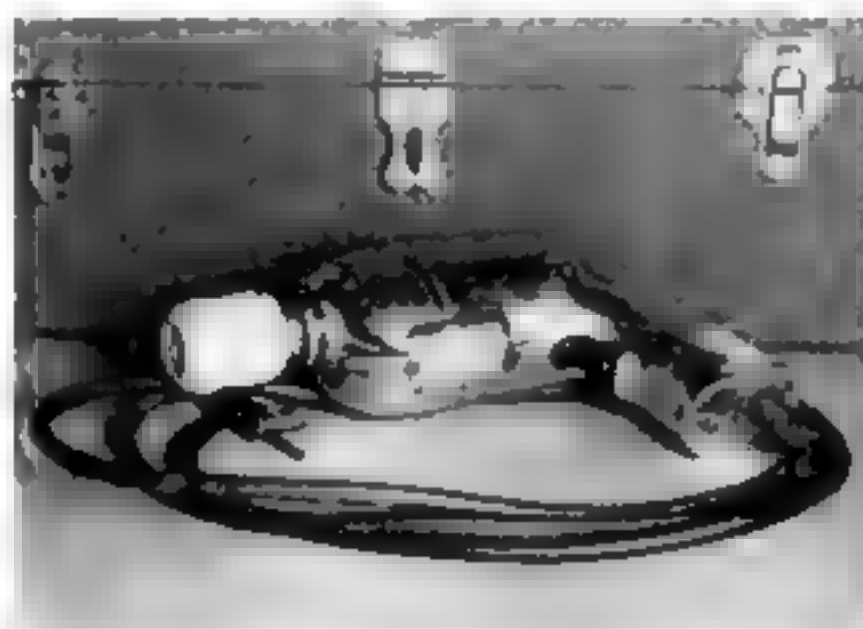
▶▶▶Ever lose track of time while making a long-distance call? It can be a shock when the phone bill arrives. Keep an egg timer by the telephone. It gives plenty of warning that your three minutes are nearly up.—*H. C. McClellan, Willow Grove, Pa.*

▶▶▶I got so many cigars last Christmas I was afraid they'd go stale before I could smoke them. I wrapped the unopened boxes in foil and stored them in the freezer unit of my refrigerator. They've kept completely fresh.—*J. H. Matthews, St. Louis.*



Making special nails

You can convert common nails into special types: For an L hook, snip off the head, flatten the end, and bend as at left. To enlarge a nailhead, drop the shank through a hole in a metal bar and peen the head (center). File a countersunk head (right) by chucking the shank in a drill press.—*R. J. De Cristoforo, Los Altos Hills, Calif.*



Drill-chuck guard

If you tote a $\frac{3}{8}$ " electric drill in your toolbox, protect the chuck by slipping on a crutch tip. This rubber shield not only guards the key-engaging teeth from impact with heavy tools, but keeps toolbox dirt out of the chuck mechanism where it can cause wear and make jaws hard to adjust.—*Harry Walton, White Plains, N. Y.*



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attached to the rotor both act like gyroscopes. As the drawings show, a gyroscope reacts to a force placed on it by tilting at 90 degrees, or *sideways*, to the original point of force. This is used in several ways to provide stable flight.

The upward gyroscopic twist of the propeller tilts the rotor blades up to give the copter lift for taking off and climbing. A similar gyroscopic reaction is given to the rotor by weighting the copter tail-heavy. This causes weights fastened to the leading edges of the blades to twist the blades downward and reduce lift as they advance into the air stream—just like the cyclic-pitch mechanism on big copters.

An additional gyroscopic reaction in the rotor forces it to tilt downward at the nose to keep the model flying forward. Earlier attempts to make a model copter fly forward by simply weighting it nose-heavy proved disastrous. The rotor, pulled down at the front, reacted like a gyroscope and flipped over on its side, sending the craft crashing to the ground upside down.

Earlier models had another fault: Blade pitch was fixed at an upward angle for climbing. To provide the downward pitch for landing, the rotor had to come to a stop, then reverse its direction. This time lag caused the copter to drop a long distance before the reversed rotor got up enough speed to break its fall. In the new design, the pivoted rotor blades continue to turn in the *same* direction, but automatically tilt downward when the engine stops to let the model glide gently to earth.

Only the rotor is tricky. The copter's fuselage is a simple sheet-balsa job. But the rotor, the heart of the craft, must be carefully balanced to provide correct blade pitch and avoid vibration. The blade-tip weights are blobs of solder, each equal to the weight of three nickels. They are used only on the two nonpowered blades as the engine supplies the weight on the third blade. After the weights are mounted, gradually shave off bits of solder until the rotor remains balanced in any position. Weight the fuselage with clay until it balances at a point $\frac{1}{2}$ " behind the rotor's axis. This will make the ship slightly tail-heavy as required for proper flight.

Blade pitch is controlled by a spider-shaped plate on the underside of the hub. This works like a three-way bell crank.

When the plate is twisted by the stem on the power blade, it in turn twists the stems on the other two blades to a like angle. The U-shaped stop bracket should limit the plate's movement to provide a maximum of 12 degrees upward blade pitch for climbing. Downward or negative pitch should be set as shallow as possible for a slow, leisurely descent.

Note that the engine is mounted at an angle on the rotor blade, rather than straight ahead. This puts its thrust line at a tangent to its circle of rotation. If it pointed straight ahead, it would exert a side thrust on the rotor as it whirled around. Note, too, that it is turned partially on its side, with its cylinder tilted inward toward the rotor hub. This puts its fuel reservoir in line with centrifugal force so the gravity feed will continue to operate even though the engine is being slung around sideways by the rotor.

The engine must also be tilted slightly downward to minimize the force of its slip stream. The slip stream tends to turn the copter's fuselage to the right, but is offset by the rotor's downwash and bearing friction, which tend to swing the fuselage to the left.

The engine can be mounted on the metal bracket shown in the construction drawing or, for a neater appearance, can be faired into the rotor blade with a shaped balsa block, as shown in the photos. If a larger engine than the .020 Cox is used, it will require additional counterweighting of the rotor blades. In this case, add the extra weight to the tips of the blades themselves, not to the tip weights, which must remain the same.

Flight-testing the copter. An ROG (rise-off-ground) takeoff is slower but safer at the start since you can see what's happening. When all adjustments are perfect, you can go to the faster hand-launch.

Begin with a 6"-diameter, 3"-pitch plastic prop and trim it a little at a time until the engine reaches maximum r.p.m. Hold the ship by the tail until the rotor gains speed, and duck out of the way. The model should rise slowly, then tuck its nose down and climb in a right-hand spiral of 20' to 30' in diameter. During trials and on windy days, let some of the fuel flow through before letting go—or you may wish the copter didn't fly so well. ■ ■



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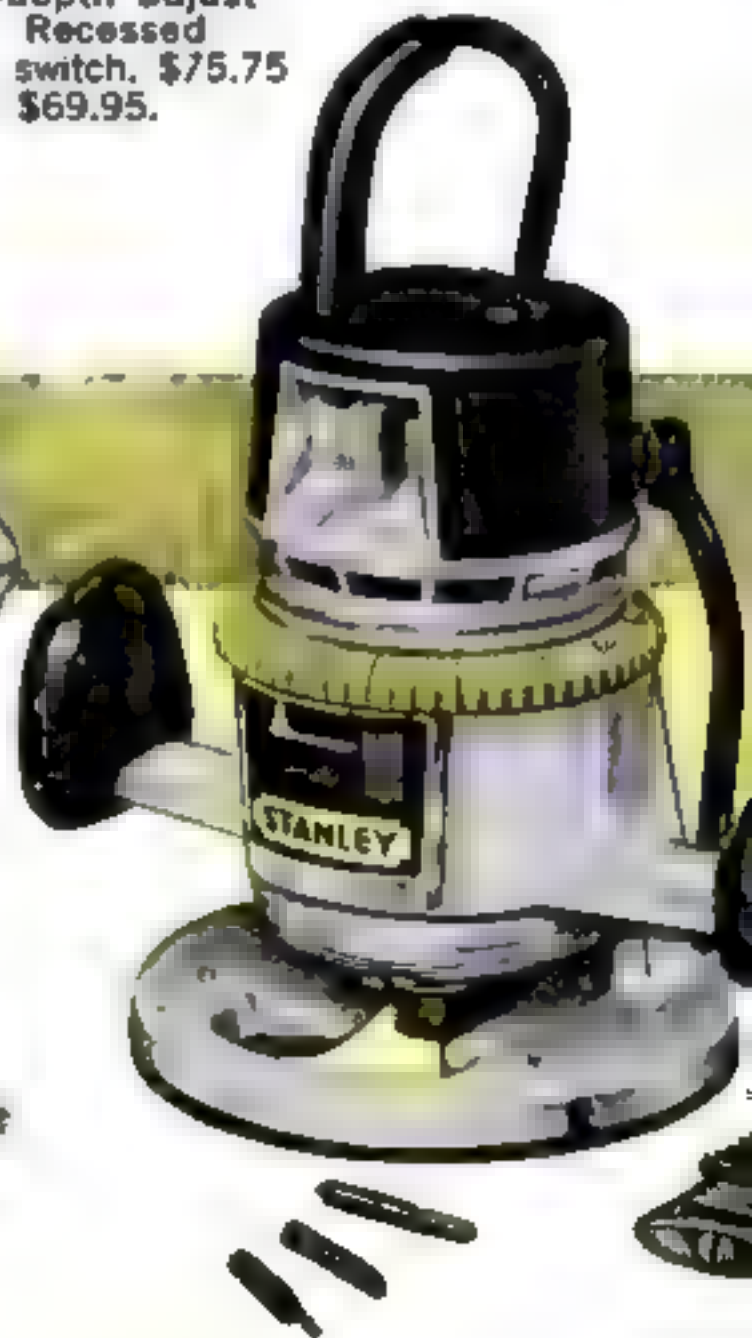
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I Rode Our Hottest Jet (Continued from page 56)

nuts and bolts flying in loose formation.

With this kind of oomph it's obvious that the line of people who try to finagle a back-seat ride in the Phantom is a mile long. According to the Navy doctor who checked me over, I was the second civilian lucky enough to make the grade.

The pilot for this trip was to be Lt. Cmdr. L. Scott Lamoreaux of Fighter Squadron VF-101, Oceana Naval Air Station, Virginia. When he asked what sort of ride I wanted, I said, "Let's try to beat Mach 2, if possible."

"If possible?" Lamoreaux said, as if he were addressing a not-too-bright child. "You must not know the airplane. What else?"

"One of your straight-up takeoffs?"

His eyes took on the fond light of a proud parent. "Of course," he murmured. "Anything else?"

"Well," I said, "anything else that you think of that's good and lively."

Lamoreaux fairly beamed. Usually there's no wild-blue-yonder stuff unless you want to talk it over with the Admiral later.

High-altitude hazing. There was the usual ground training necessary before taking off in a high-performance jet: You go through the high-altitude chamber after hearing two hours of horror stories from a medical type who seems bent on scaring you out of your wits. (He succeeds.) I emerged with a funny bubbling in my left ear, which later went away.

Briefing continued with Lt. Walt Phillips, a radar expert, who explained how intercepts are made with the F4H. An enemy, to find and destroy a Navy carrier, would have to fight its way past a dozen or so of these birds, plus a skyful of missiles from missile cruisers. Theoretically some enemy planes might get through—but not before the carrier had launched her nuclear bombers.

Lt. Jerry Ryan, a back-seat radar operator, crouched on the ladder outside the cockpit and painstakingly saw to it that we were hooked up and lashed in

I Rode Our Hottest Jet

safely. Jerry's final words were, "Don't grab hold of those loops over your head unless you mean to eject. They're as deadly as a loaded gun, right now."

We taxied out to the takeoff point. "This is Navy one seven zero," Lamoreaux said to Oceana tower. "We are ready for takeoff. Request permission to make an unrestricted climbout."

The tower came back smartly with clearance and permission.

"You all set back there?" Lamoreaux asked on the intercom.

"All set," I said, and swiped at my dry lips with a dry tongue.

"Okay, here we go."

The two J-79 engines in the belly of the plane came up smooth to full power. Lamoreaux released the brakes, and the plane began to roll. I could see the runway by leaning over to the left. It was almost solid black with rubber burns from practice field-carrier landings. They began to suck past in a blur.

I expected a belt in the bottom when the two afterburners fired, but it didn't happen. The new J-79 afterburners are sophisticated. They cut in politely, a little at a time.

Lamoreaux lifted off about midfield, sucked in the wheels, and held her low, building up speed. Then he pulled up smoothly and very steeply. I stared out the side window, fascinated. It must be something like the sensation an astronaut feels when his Atlas leaves the pad—only faster. (The Atlas is very sluggish for the first couple of thousand feet or so; the Phantom is not.)

Oddly, there was a plugged-up painful feeling in my ears. Normally this only happens when letting down. In somewhat less than 2½ minutes we were at 40,000 feet. The field was still directly under us: We had come straight up.

Mach 2 plus. "All right," Lamoreaux said. "We'll go out to Mach 2. One thing to remember. Sometimes we get a stall in one engine as we pass Mach 2. It sounds like a heavy shell exploding in the cockpit, but don't let it bother you. She'll shake pretty hard for a second or

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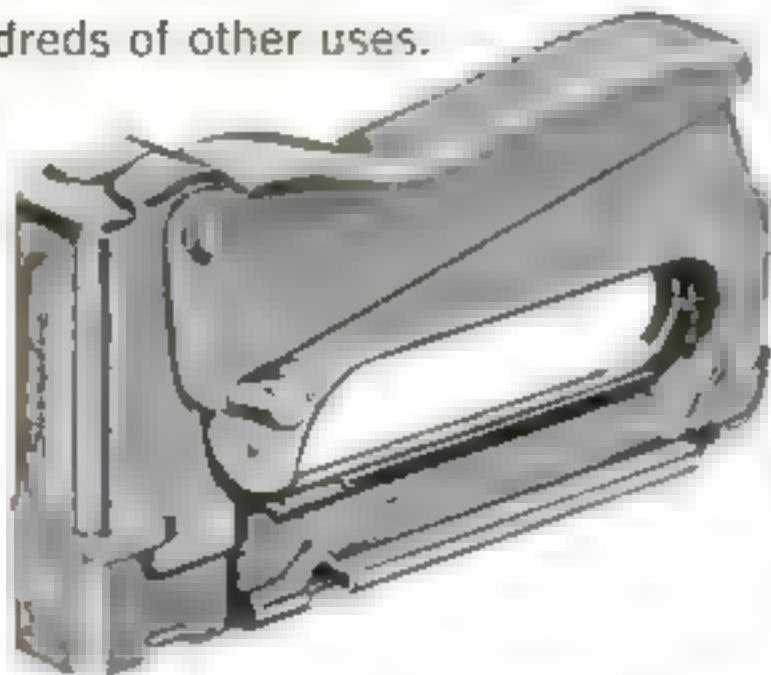
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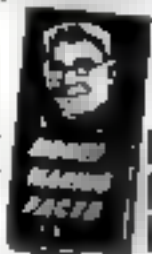
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so before I cut the burners. But then she'll be fine. No sweat."

I watched the Mach meter. The Phantom II went through the speed of sound almost as soon as we leveled off, but getting up to 1.3 required about two minutes of wide-open running. After 1.3 the speed took a jump, and suddenly he said, "There she is—Mach 2!"

I looked at the meter. Mach 2 it was "Mach 2.05," Lamoreaux said.

We felt the buffet begin.

"Mach 2.1," Lamoreaux said "Feel that stall nibbling at us?"

"Yep," I gasped, tense for the violent explosion of the heavy shell.

"Mach 2.15," Lamoreaux said. "Guess I'll quit while I'm ahead."

He cut the burners and the Phantom slowed as if we'd thrown out a sky hook. We sank back from the 1,400 m.p.h. we'd been doing to a mere 1,350. The shudder went away.

It was a beautiful clear January day. We could see contrails below us at 35,000 feet: two Air Force F-100 Super Sabres. Lamoreaux, who flies with an angel's touch but applies G loads and ear pressure with quick-as-a-rattler suddenness, eased us over on our back.

The earth above. I stared through the canopy at the earth, above us now, 40,000 feet away. Then it started to tilt around as we dived vertically. Needles stabbed both eardrums. I was ready for this. I grabbed my nose through the rubber mask, held it, and blew back hard and quick. My ears popped with squeaky snicks. The sound of the jet, which had been dull and remote, came clear again. Lamoreaux was pulling out. I lifted my right hand. It felt as if it was coated with six inches of lead. The nose came up. The earth shifted away from dead ahead and resumed its normal position below us.

"You okay?" Lamoreaux asked solicitously.

"Yep," I said, hoping the gaspy timbre of my voice didn't get through.

"I'll just make those little buddies feel good," Lamoreaux said, chuckling. "I'll

I Rode Our Hottest Jet

drive up beside them with my speed brakes extended."

We overtook the two F-100s and Lamoreaux took up a position close aboard one of the Air Force jets so we could look back and forth at each other. Normally this sort of thing triggers a dogfight. But nothing happened. The guy in the white hardhat looked at us. I waved at him cheerily. He lifted a hand in a short gesture as if to say, "Aw, get lost, you big show-offs!"

Lamoreaux pulled in his speed-boards, lit off his two burners, and away we went, almost straight up again. When I looked back and down, the little Super Sabres were still toiling along like a couple of sluggish toys below us. We were at 46,000 feet.

"Wish we could find a couple of F-104s," Lamoreaux said. "Those F-100s haven't got a chance and they know it. That's why they didn't even try."

Squirting into space. We horsed around the sky for about an hour until we had burned up enough fuel to make the F4H lighter than the thrust of her engines. Then, out of a high-speed level run at 10,000 feet, Lamoreaux pulled the vertical climb where you squirt up faster and faster instead of slower and slower, straight for outer space. Then he rolled out on top at 46,000.

We came back down and practiced five field-carrier landings. The heavy bird does, indeed, fly very slowly and with great stability and safety, but when it bangs down on the runway you really don't expect to escape without at least one blown tire. I remarked as much to Lamoreaux over the intercom.

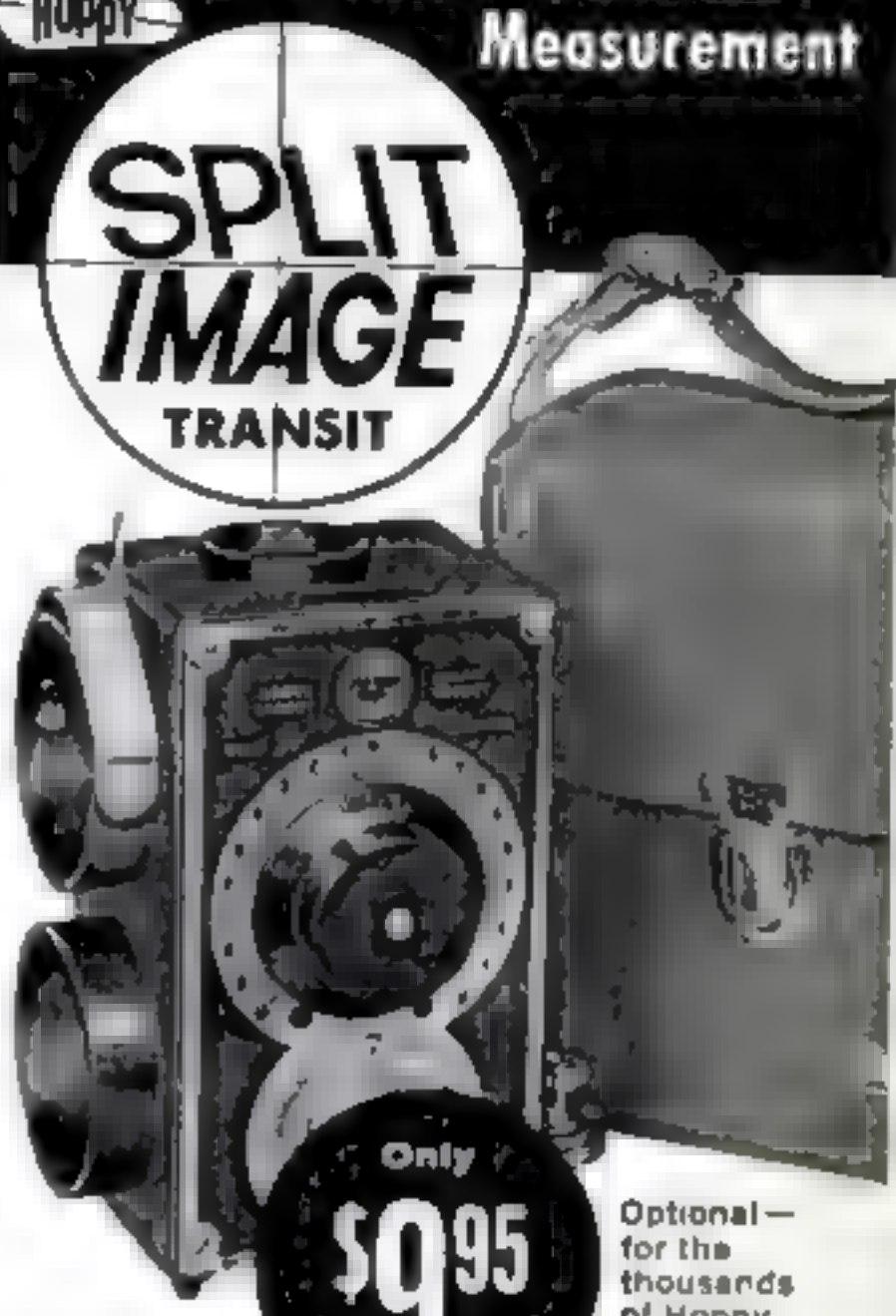
"Nope," he said. "Not with these tires. Twenty-eight ply, 400 pounds inflation pressure. They'll hack it, don't worry."

They did. After landing number 5, we came in and made a normal approach, popped the parachute, and that was it. A breathtaking but perfect ride. Of course the funny bubbling did come back in my ears during the last high-speed dive. But I'm not worried. No doubt it'll go away one of these days.

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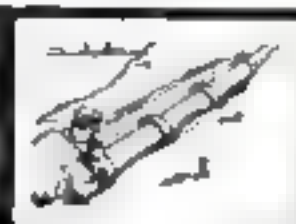
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When You Buy a Dado

[Continued from page 152]

ameter affects width of cut at each setting so it's wise to use the same blade all the time and to remember that fact when the blade is sharpened.

Speed is a factor with both types of wobble units since centrifugal force will cause the blades to flatten out slightly—enough to cause errors. The higher the speed, the narrower the cut. For the same reason, it's not possible to determine width of cut with the blade at rest. You must make sample cuts in a gauge block and mark their settings. The work thickness is then matched against a cut that fits and the tool is set accordingly. If the tool is used at a different speed, or if the blade is changed or sharpened, you'll have to start a new gauge block.

The sandwich-type dado. Conventional dado assemblies consist of matched outside blades, and chippers that you place between them. The outside blades form the sides of the cut, and the chippers clear away the stock in between. The common problem—failure to get a flat-bottomed groove—is caused by uneven cutters. Unless all the cutters are expertly jointed as a unit and mounted in the same position on the arbor each time, you won't consistently get a flat bottom. Once a dado is cutting perfectly, it's a good idea to clamp all the parts together with a nut and bolt when they're not being used so you can keep the blades in the same position. The number and arrangement of blades will change, of course, as the cut width changes, but in most cases it will be possible to keep whichever ones are being used lined up the same way.

Apparently, precision jointing is reserved for higher-price units because it's a hallelujah day when a popularly priced assembly works ideally right off. It's more likely to occur in a hollow-ground unit than a flat-ground one simply because the former is a more expensive design to begin with. Obviously, it's a price factor, but all is not lost. You can take any ordinary dado assembly to a good sharpener and have it jointed, if a trial cut shows that this nuisance chore is necessary. Still, maybe you'll be lucky.

Width of cut is determined by the combined thickness of the outside blades plus the chippers you place in between. A common assembly consists of two outside blades, each cutting a $\frac{1}{8}$ " kerf, two $\frac{1}{8}$ " chippers, one $\frac{1}{4}$ " chipper, and one $1/16$ " chipper.

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When You Buy a Dado

Various combinations will give you cuts from $\frac{1}{4}$ " to $\frac{13}{16}$ " wide in increments of $\frac{1}{16}$ ". When the work is not exactly matched to an obtainable cut width, you use paper shims to spread the chippers slightly apart (their cutting edges overlap enough to permit this).

One thing sure about an assembly—you know where the outside blade is. Unlike the wobbler, this gives you a positive point to measure from, or to line up with. Reasonably good dado assemblies are available for \$10 to \$20. A top-notch hollow-ground job, of course, runs more.

The Quick-Set dado. Spin one of these on your finger and you'll have to look real close to fathom its slick engineering. A flat core studded with eight cutting knives is sandwiched between matched, tapered outside plates. At the minimum $\frac{1}{4}$ " setting, each of the eight blades cuts in the same plane. As you tilt the core disk between the tapered plates, you, in effect, spread the knives apart so they cut a progressively wider slot.

While the tilted knives act something like a conventional wobble blade, they are jointed in such a way that you get an absolutely flat-bottomed cut at their maximum width of $\frac{3}{4}$ ". This enables you to produce square-sided rabbets by using either all or only part of the available cut width. At in-between settings, there is a very slight arc to the bottom of the cut, similar to that produced by a wobbler.

Like a wobbler, the Quick-Set also has the advantage of being infinitely adjustable from minimum to maximum width. In depth of cut, however, it is a bit more limited than either the wobbler or sandwich-type dado. This is because the outside plates form a shoulder that prevents the knives from cutting any deeper than the amount they project beyond the plates. In the case of the 6" model, this is $\frac{3}{4}$ ".

The high-speed, tool-steel knives look more like machine bits than saw blades or chippers. Four are relief-ground and razor-sharp on the left side, the other four on the right side. The manufacturer, Comet, has eliminated any possible trouble in keeping them in good shape by announcing five free sharpenings with each purchase. Since the original condition of the bits is excellent, the free sharpening should be enough to last the life of the tool. The price is about \$20. ■ ■

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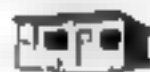
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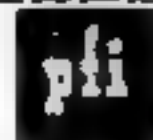
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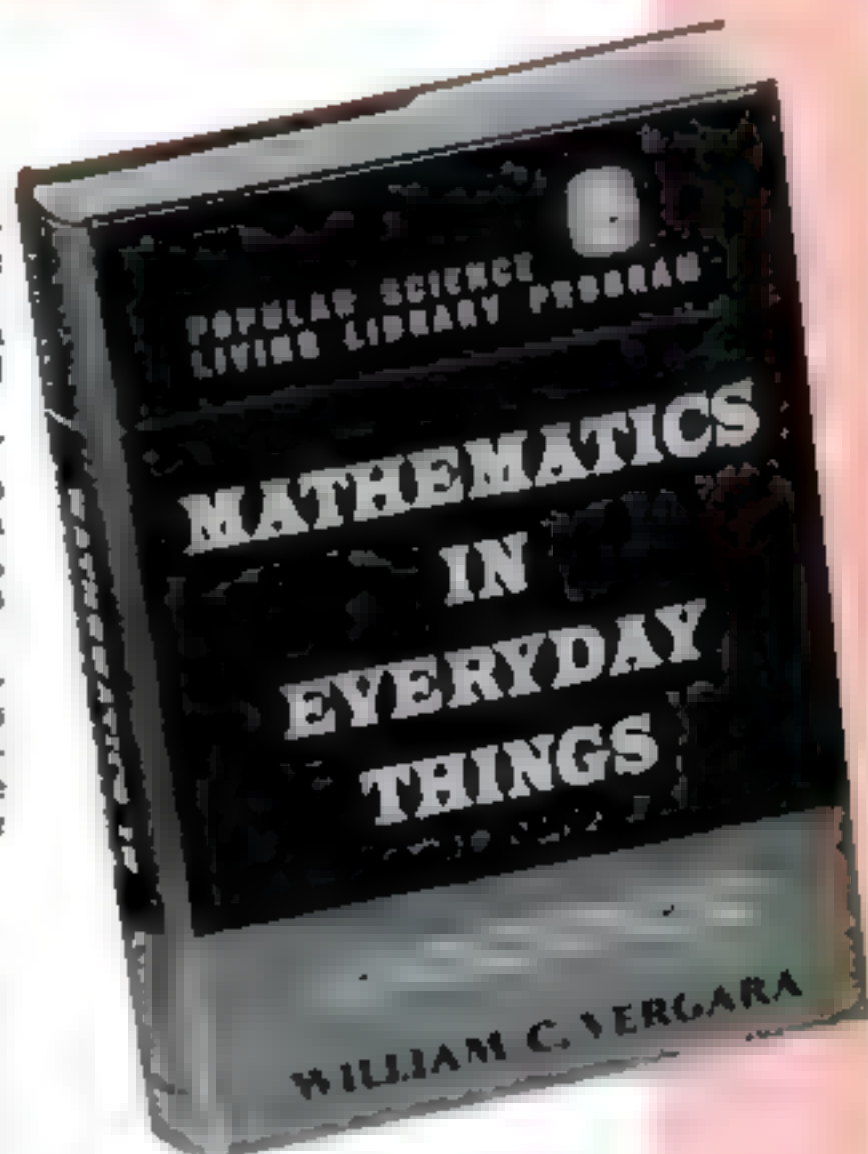
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How Typewriters Give Criminals Away

[Continued from page 39]

noticed something that brought a smile.

"The paragraph is a fake," he told Robinson. "I'll see you in court."

The overlapped loop. On the stand, Tytell testified that the upper loop of the "b" in Robinson's signature and one of the words in the key paragraph overlapped. But the handwriting was *underneath* the typewritten material, proof that the paragraph had been added after Robinson had signed the document.

Tytell reports that as businesses and governmental agencies increase their paperwork each year, the number of typewritten documents used for fraudulent purposes increases correspondingly. Phony notes, drafts, wills, contracts, checks, bills of lading, diplomas, service discharges, and medical certificates can all be used by the smart con man or commercial cheat.

To learn how a typewriter detective operates, I visited Tytell in his laboratory. It was an introduction into a fascinating world of type, type charts, microscopes, and lighting equipment. Tytell has thousands of type faces that can print in 145 languages.

"What's the first thing you do when you get a case?" I asked.

"Determine which company made the machine," he answered. "Each firm has a distinctive type face. All U.S. typewriters, for instance, dot their 'i's directly above the vertical stroke, except L. C. Smith machines, which have dots slightly to the left.

"Next I try to pinpoint the model," he said. "Firms periodically change type faces."

"Case of the Forged Receipt." This one started when the manager of a large warehouse contacted Tytell and told him about a woman who wanted to remove some expensive paintings. Her itemized receipt showed they had been stored during World War II.

When a search failed to turn up the paintings, the woman demanded damages. Before paying off, the manager decided to check the receipt with Tytell.

How Typewriters Give Criminals Away

The receipt was dated 1943. Tytell focused in with a microscope.

Suddenly he rose and went to his charts. They told him that an "a," supposedly typed in 1943, was first used on a machine produced in 1945.

Other cases have been solved by broken type faces and worn type.

The nicked commas. A case involving a contested multi-million-dollar will revolved around a slightly imperfect comma. During his examination, Tytell discovered that commas on the third page of the will all had a slight nick. Commas on the other pages were perfect. Then he knew that the third page had been typed after the other pages.

"Authorities merely had to answer the question—'Who benefited from the provisions of page 3?'—and they had their man," Tytell said.

Even ribbons can provide clues. A company president had left substantial bequests to all of his executives—except the company attorney, who got a mere \$100. The attorney, however, managed to see the will before the others, and he deftly added a comma and three zeros to his bequest—raising \$100 to \$100,000.

Other company officers brought the will to Tytell.

He attacked the problem with a bottle of ordinary hobby cement, which contains acetones and acetates, gently dabbing some of it on the "100,000." Within a few seconds, the pigment dissolved on the paper. The officials saw that the first three figures were one color, and the comma and last three zeros another.

"The attorney was smart enough to use the same typewriter," Tytell explained. "But different ribbons, even of the same color, have differences in pigmentation that are brought out by acetones and acetates. Unfortunately for the attorney, the ribbon had been changed between the time the will was typed and the time he added the zeros."

Confronted with the evidence, the attorney waived all claims and resigned from the company.

The poison penman. If technical evi-

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How Typewriters Give Criminals Away
dence isn't conclusive, typewriter experts often rely on other forms of evidence. Perhaps Tytell's favorite case is down on the books as the "Search for the Angry Commuter."

The superintendent of an eastern railroad had received a long, rambling letter viciously attacking a railroad employee. The letter began:

"Dear Sir:—

"Do you know that the man working the first trick in the Eastwood Tower is an Epileptic, a heavy drinker, and a wife-beater? I am a Next-door neighbor of his and I know."

The charges, if true, were serious enough to warrant an investigation, but the superintendent didn't want to confront the towerman himself. Tytell was called in to find the poison-pen author. He examined the letter.

Paragraphs were indented only one space. The writer used a period between city and state in the address, not a comma. The letter "w" was off its feet. The "v" was broken. A colon and a dash ":-" were used in the salutation. The writer used such typical railroad terms as "trick" and "tower." He identified people by their first initial and last name, a practice common to the railroad. He used unnecessary capitalization.

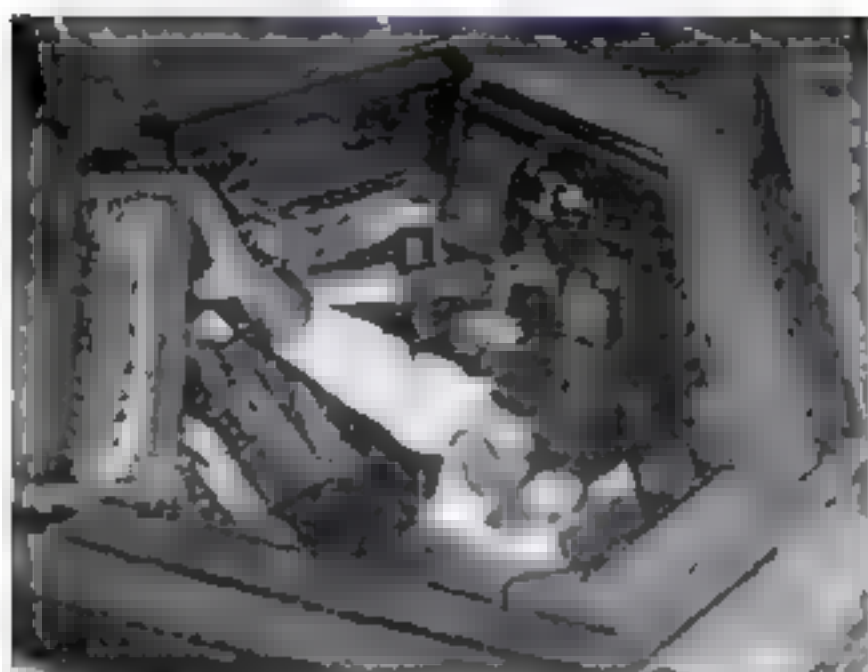
"I decided that our poison-pen writer was a railroad worker," Tytell said. "We make a habit of checking fellow employees first. In this case we checked other towermen, plus workers with access to typewriters in the same division."

The railroad cooperated in obtaining sample letters from all possible suspects. Tytell checked these, point by point, against the anonymous note.

"Our hunch was right," Tytell said. "Our man was a railroad worker with a personal grudge against the towerman. He was amazed when we confronted him with the evidence

"In many cases," Tytell added, "a type-written page is better evidence than a fingerprint, and the story it tells often contains more human drama than a mystery novel."

World's Biggest Robot
[Continued from page 63]



Room for operator and nothing else—that's cab of Beetle. Control buttons for engine, generator, cab movement cover walls. Arms are worked by toggle switches in front of operator.

are precise but slow, for that cab weighs 50 tons.

The walls are made of foot-thick lead covered inside and out with half-inch steel plates. The entrance hatch is a tight-fitting cork of lead directly over the operator's head. It alone weighs 7½ tons.

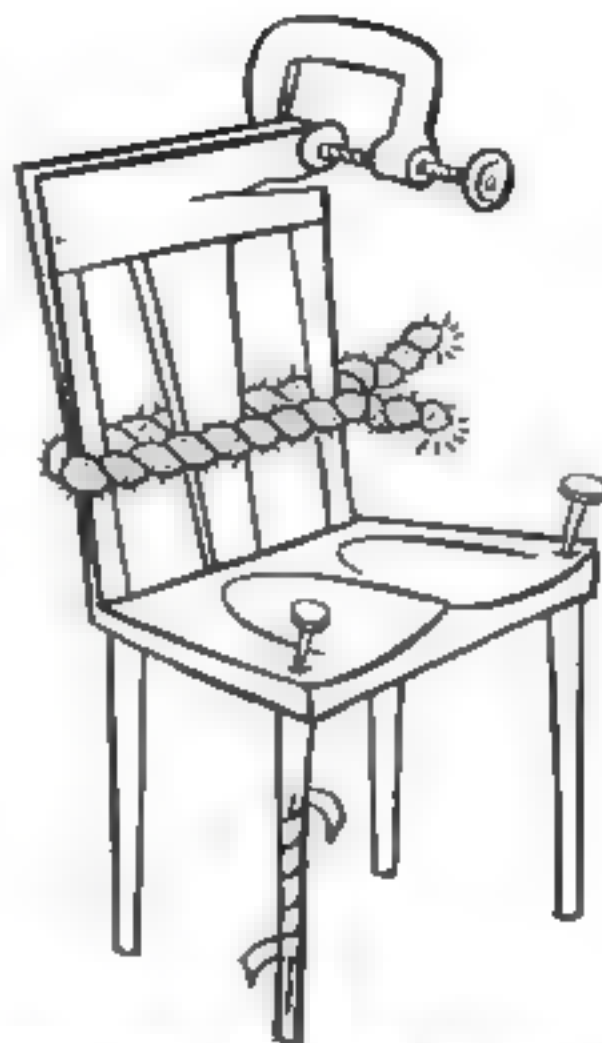
The hatch offers the only way in—or out.

Understandably, there are four separate mechanisms for raising it: the regular hydraulic system, a battery-powered hydraulic pump, a hand pump on the operator's left armrest, and a hand pump outside the cab.

Even with the four independent emergency outs, the operator's seat is still no place for a guy with claustrophobia. It's eerily oppressive even when the hatch is wide open (I tried it).

Those 50 tons of lead and steel form the most effective suit of armor ever wrapped around a single man. It cuts down atomic rays by 3,000 times. That means the operator could put in a full day's work where the radiation level was 3,000 roentgens per hour. Unshielded, exposure to such intense radiation would probably kill him after 10 minutes.

The man who will seal himself inside this massive machine is young, flamboyant Randall Scraper, who comes from



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World's Biggest Robot

Indiana but is always called Tex. Scraper is one of the most skillful of an elite corps of technicians, the professional manipulators.

These specialists perform the same work as any repairman—taking machines apart and putting them together again. But there is one big difference: The manipulators work on machines too "hot" to get close to. They cannot touch their work or even their tools. Everything must be done at long range with mechanical arms.

No sense—no feeling. The arm is a stainless-steel-boned, electrically muscled copy of human equipment: shoulder, upper arm, elbow, forearm, wrist, and hand. The joints are superhuman: They spin around and around as well as bend. The hand is usually a two-fingered claw that can grasp and maneuver parts or tools; but it can be snapped off and replaced by any of several specialized types—a socket-tipped finger, for instance.

The steel hand cannot feel, however, and that is a serious loss. You can't tell whether you are crushing something or holding it so loosely it will fall. (Dropping a nut or screw seldom matters; spilling a can of radioactive material could tie things up for weeks.)

Working with mechanical arms is like playing the nickel-in-the-slot claw machine at an amusement park—and snaring the toy compass every time. It takes unusually sensitive coordination as well as icy calm concentration—outwardly at least. Tex Scraper steadily chews gum and cigars, often both at once. But he possesses the supreme patience to devote eight hours to removing one nut from one bolt.

"I can do that," Scraper drawls. "because I turn my ears off. People are always watching, trying to help. 'A little to the right,' they tell me. Well, it may be their right and my left. So I've taught myself to pay no mind. I don't even hear them."

The Beetle is worth its cost solely to take Scraper and his mechanical arms

World's Biggest Robot

up close to the hot nuts and bolts. He gets safety and a clear view of the work (not perfect, yet better than television). But he pays for these advantages with total isolation.

The operator is sealed tight as a mummy. There is barely space to wiggle a foot; standing or stretching is out of the question. His only direct connection to the outside world is an air intake. (The duct zigzags, like the entrance to a photographic darkroom, so that radiation cannot "shine" in. Special filters are unnecessary because the air itself does not become radioactive.)

A three-ton air conditioner keeps Scraper cosy (72 to 76 degrees, 60-percent humidity) even if the temperature outside plummets to 25 below or flames to 130 above zero. He talks to base by radio (two separate transmitter-receivers) or public-address system. There's even a microphone out front so that he can listen to the engine.

A room with a view. Even more elaborate are the arrangements for looking out.

To go with the windows, there are two pairs of binoculars on swinging mounts; with them Scraper can read the scale of a standard micrometer gauging parts many feet distant.

There is a retracting, submarine-style periscope that rotates and tilts.

Finally there is closed-circuit TV. The screen sits between his legs. One camera is clipped to the cab, like a pencil in a man's breast pocket. It can be picked up and moved around by the mechanical arms. Two fixed cameras point to the rear so that Scraper can see what's going on behind him—outside rear-view mirrors are impractical.

The Beetle's cab even includes a few luxury accessories: a comfortable, power-adjusted chair, ash tray, lighter. Most important of all, perhaps, is an oxygen bottle. If absolutely everything went wrong, it could sustain Scraper for eight hours. Presumably that would give time to haul the machine out of danger, cut the cab open, and free him. ■ ■



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Incidentally, the 406 is a true production engine. About 10,000 or more of them, including about 2,000 milder, four-barrel-carburetor, 385-hp. versions, are slated for production in 1962. The Mercury Monterey will also be available with the identical 406, but only with the four-speed gearbox.

Hottest "hot one." Next morning the weather had improved somewhat, but the roads were still wet. We drove to the General Motors proving grounds in Milford, Mich., where a 409-inch Chevrolet with four-speed gearbox was waiting for us. This baby has as many horses as cubic inches, 409—and at 6,000 r.p.m., at that. Torque is a fat 420 pounds-feet at 4,000 r.p.m.

Though heavy-duty parts such as firmer shocks, heavy coils, sintered-metallic brake linings, an anti-sway bar, and reinforced racing wheels are available, they are strictly optional.

Choice of transmissions is similar to that of the Ford 406: A three-speed column shift is standard (but no floor shift is available with this box); that slick Borg-Warner four-speed is optional. Chevrolet doesn't offer a conversion kit to quicken steering, but power assist is available. And it's a good choice, since it offers a 24:1 overall steering ratio as compared with 28:1 for the standard setup. Power brakes are also available.

The engine bore is 4.3125 and stroke is 3.50. Along with larger valves and ports and stiffer valve springs than those of the 348, there's a redesigned combustion chamber with 11:1 compression and a new camshaft, radical enough to require a 700-r.p.m. idle.

Respiration is handled by two quad carburetors. Enlarged headers and over-size pipes take care of the exhaust. A larger-capacity fuel pump feeds the engine. Ignition is standard except for dual breaker points. A clutch with heavy-duty facing helps get the show on the road.

Fantastic acceleration times. After I was through prodding and poking the power plant, Bill and I climbed into the

Impala test car. Bill strapped himself in securely and, noting the expression of glee on my face, accepted the stop watch with some misgiving.

The engine screamed, the clutch popped, and we smoked out. In the low 50s I snapped it into second. The 0-60 time: 6.7 seconds! That's enough to give Corvette owners fits. The engine put out so much brute power that even when I varied my shift point widely there wasn't more than a couple of tenths' difference in time.

Next we tried 0-80. We polished it off in 10.6 seconds. By now the track didn't look too slippery and we decided to go for 0-100. Our time was 16.5. But the optional 4.11 rear end in our test car, which helped in our 0-60 runs, hurt our 0-100 time. With the standard 3.36 ratio, butyl tires for better traction, and a dry pavement, we probably could have knocked off a couple of seconds.

Brakes on the car were superb, but the manual steering was too slow. And the standard springs and shocks are too soft for vigorous driving. I recommend the police-taxi heavy-duty suspension.

Ponti-action. The following morning the weather hit us with a vengeance. The rain poured down, with no indication of stopping, but Bill and I went over to Pontiac anyway. There a Grand Prix—basically a Catalina with firmer suspension and bucket seats—was waiting, complete with four-speed box and 421-cube V-8.

This engine has a 4.09 bore and 4-inch stroke. Its 405 hp. (up to 432 hp. when specially tuned) is developed at 5,600 r.p.m. Torque is 425 pounds-feet at 4,400 r.p.m. The camshaft is wild enough to require a 1,000-r.p.m. idle speed, and even then the engine is as jumpy as an expectant father in a maternity hospital.

The heads are completely different from those of the standard 389 engine. Compression ratio is up from 8.6 to 11. Heavier valve springs, larger valves and ports, and mechanical lifters allow the engine to reach an easy 6,500 r.p.m. The

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Detroit's Stock-Car "Monsters"

421's feeding habits are finicky. There's detonation even with some brands of premium gas.

Larger main bearings and forged-aluminum pistons provide extra durability. Carburetion is via two quad-throats. Smooth headers, a six-quart oil pan (the standard one holds four quarts), and a high-pressure oil pump wrap up the major performance features. No automatic transmission is available, but both three- and four-speed manual boxes are.

Braving the slippery roads. The car was waiting, and the rain had let up somewhat. The pipes growled and the carbs hissed when I fired up. Those two tiny aluminum-mesh air cleaners served more as butterfly catchers than silencers. Gingerly I engaged the clutch—and stalled. This temperamental baby isn't used to slow starts.

I twisted the starter key again, fed more gas, and we were off. The optional bucket seats are well padded and give more lateral support than most Detroit models. A tach (optional) perched on the console, where it was rather hard to read. The gearbox lever is short and well placed. Steering was slow—29:1 overall—but the 22.5:1 ratio of the power unit should be a big improvement.

I asked Bill whether he was game for some 0-60 runs. I interpreted his silence as an expression of assent. In spite of slippery conditions, our best time was 6.1 seconds. Our test car was equipped with standard 4.30 rear end, but ratios ranging from 2.56 to 6.14 can be fitted.

The weather scared us out of trying for top speed, but Pontiac engineers told us of supertuned 421s hitting over 170. And that's with 4,000 pounds of car. Factory-stock, the 421 has to top 150 to even be competitive at the stock-car races, for which it's obviously pegged.

Where can you drive these monsters? Any nice open stretch is okay—like the Bonneville salt flats, for instance.

So these over-400-inch engines aren't the most practical mode of everyday transportation. Still—it's a great feeling just to know that the power is there. ■ ■

[Continued from page 145]

You can do this by sending more electricity through the heater. A step-up transformer that increases voltage by about 20 percent will give more brightness if the trouble is low emission.

Brighteners—the gadgets you buy. Now that you have the necessary theory to extend picture-tube life, let's review what is commercially available. There are simple brighteners for all three types of tubes—duodecal, button, and shell. They come for both parallel and series-wired chassis. These brighteners are the inexpensive ones and they are wound as autoformers. That is, the primary and secondary coils are all one winding, and tapped. For a simple case of low emission, these are the kind to buy.


A variation of the autotransformer brightener is a series-parallel job. It costs more but can be used on either a series- or parallel-wired chassis. There are three types, one for each tube base.


The most expensive type is a universal device. It can be used as a brightener-isolation transformer for either series or parallel circuits. It comes in three types for different tube bases.



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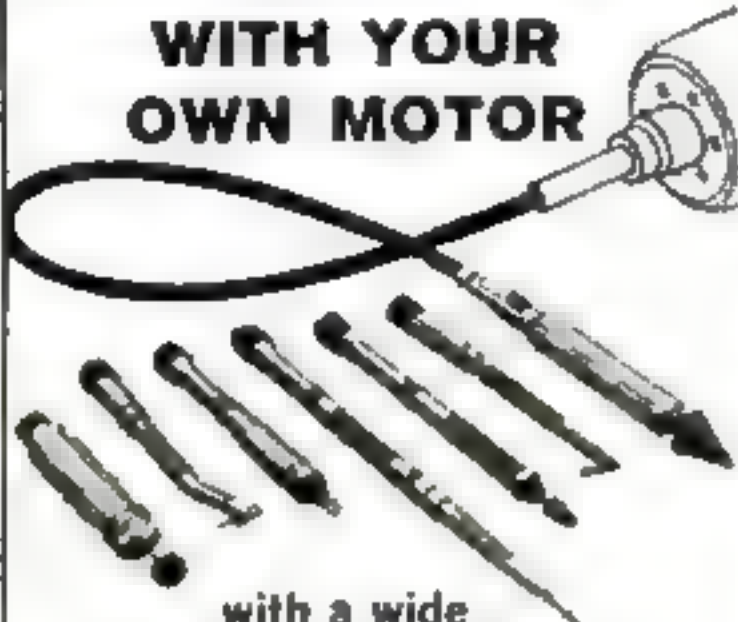
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210 POPULAR SCIENCE MAY 1962

Confused About Color Film?

[Continued from page 140]

an ASA of 40.) Eventually, the new film will replace the old entirely. Eastman has already discontinued the old-style Type F. This was an indoor film designed for clear flash. Seems the increasing practice of using daylight film with blue or electronic flash has killed the demand for a special flash film. (If you insist on one, you can still get Type F in Ektachrome.)

Two from abroad. A couple of famous West German films have just appeared on the American market. They represent the opposite side of the color coin. There are only two basic patents on color reversal film. Kodachrome holds one; the dye components are in the developers—which is why processing is a tricky three-step procedure requiring accurate chemical controls and elaborate equipment. The other patent (with the dye components in the emulsion layers) used to be held by Agfa, but was a war casualty. In the free-for-all that resulted from Agfa's rights loss, widely scattered companies produced their own versions of the Agfa original. These include the process-at-home films—Ektachrome and Anscochrome—and the European color reversal films which, up to now, have been known only to those Americans who tried them out abroad.

Today, you can experiment with two of these European films without leaving your back yard. And one is the daddy of them all—Agfacolor, an improved version of which goes into national distribution about the time you read this. To conform to the useful U. S. distinction between transparency and negative color film, it will be rechristened Agfachrome. (The company's negative film, which has been sold here for several years, will remain Agfacolor.)

Another, newer German film has preceded Agfachrome to these shores: Perutz introduced its color film abroad several years ago, and became, last November, the first foreign company to break into the U.S. color-transparency market. Both films are sold with processing prepaid.

To assure rigid quality control, each company has established its own processing labs in the U.S., under the supervision of imported technicians. The mounted slides are mailed directly to your home, just as American films were before the government stopped manufacturers from including processing in the purchase price.

Confused About Color Film?

There are no home processing kits for Agfa and Perutz. But Perutz processing offers a unique bonus: Your slides are returned in sturdy snap-together plastic mounts.

But the real excitement is in the films themselves. There's a distinct difference between domestic and Continental color films, even though (with the exception of Kodachrome) they're related. The first thing you're likely to notice is a greater subtlety. U.S. films are strong on vivid hues—fire-engine reds, succulent wet greens, dramatic deep blues. The German imports represent the quieter European approach, and feature delicate variations in color shading. Pastels and sky colors are rarely beefed up.

Not that the imports are that much alike. Of the two, Agfachrome might be said to be the softer, more muted film—notable for its glowing greens and buffs. Perutz is the richer film, with crisper detail, standing midway between the European family and Kodachrome in its heavier color saturation and emphasis on blue. Our test exposures at three different stops confirmed that Perutz color has exceptional latitude. Flash shots were notable for the absence of flat, contrasty lighting and opaque shadows.

Perutz and Agfachrome are somewhat grainier than Kodachrome. It's the price you pay for the greater speed—both films are twice as fast as Kodachrome II, five times faster than the original Kodachrome.

More from Eastman. The imports have no corner on speed, however. Eastman has also just released an improved Ektachrome that's twice as fast as the standard E-2 type. If you own a 127-size camera, you can strut ahead of the pack, because the new film is offered only in that size, at present. It boasts improved definition and color rendering, increased exposure latitude—and better contrast. We tested it in a box camera with built-in flash: It tended toward high contrast in bright, low sunlight; soft contrast and low saturation in hazy light; and excellent edge-to-edge response to AG-1B bulbs. Detail was sharp through varying depths of field. In short: a versatile film that should be virtually fool-proof in a fully adjustable camera.

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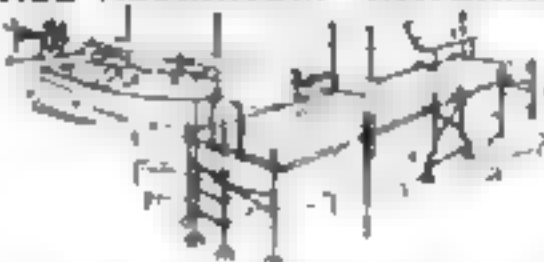
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Confused About Color Film?

processing price), but there's no immediate prospect of other sizes being offered.

Fast as they are, none of these new entries challenges the color-speed champ: Eastman's High Speed Ektachrome remains the fastest by far, with Super Anscochrome its closest rival. If you don't mind the coarser grain, they're still first choice for stopped action and available-light shots indoors and at night. In fact, for a universal film—one you can use almost anywhere—you can't do better than either of these in Type B. For outdoor shooting, you just clap on an 85B filter; your ASA (80) is still higher than most films designed for daylight. And daylight types make poorer universal films since they require heavy filtration for use with studio lights.

Polaroid's old refrain. The top news in color photography may break later this year. Just when Polaroid will release the "instant" color film they've been working on for a decade is anybody's guess. The film is already in limited production, for testing purposes, and unless drastic changes are made before it's put on the market, it will be a medium-speed film, producing finished color prints in about 1 $\frac{1}{2}$ minutes. Prints from test-run stock have been remarkably free of grain structure, and the company's concern, at present, is to keep the colors as faithful to nature as possible. Polaroid faces a fearful challenge, here. You'll have the print on the spot, for direct comparison with the original.

Which film should you buy? Each film in our chart would be the *best* film for certain subjects. If you're shooting a circus parade or a sunset, you're not likely to object to a little heightening of color values. A gull on the wing or a New England church spire may be enhanced by Kodachrome's dark blue sky. For a rain-fresh meadow or a woodland picnic, Anscochrome's intense greens are fine. But to capture the delicacy of a flowering cherry tree, or the hushed mood of a misty seascape, you may prefer the softer European hues. Coarse grain may be objectionable in a closeup of a peaches-and-cream complexion, but it can contribute poetic atmosphere to a smoky campfire at dusk.

The exciting thing today is that, for the first time, the color photographer has a wide range of choice. Each film has a distinctive personality he can exploit to add zest and variety to his pictures. ■ ■

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Off-Highway Driving [Continued from page 113]

is important. So is a tire pump, since you may temporarily have to reduce pressure for traction in sand. A fiber-glass repair kit is handy for plugging a ruptured gas tank or crankcase. Use only epoxy resin; other types don't adhere well.

Chrysler engineers recommend a compass and matches. And a few chocolate bars, they remind you, are the best thing for quick energy. In the north, they suggest packing snowshoes in winter. (Skiing your way back to civilization is riskier in rough country.) On the same subject, Bert Reinnow, a Pinedale, Wyo., veterinarian who drives a standard hard-top over lonely roads to ranches within a hundred-mile radius, says: "Don't forget to take along a blanket or sleeping bag, overshoes, gloves, and ear muffs."

Another off-the-pavement driver, Bill Isaacs, owner of the Circle S Ranch near Cora, Wyo., who drives fishing and hunting parties over jeep trails in the Wind River Mountains, suggests investing in a sheepherder's jack. This is a large, heavy-duty jack that can raise a car wheel two or three feet. It can also double as a winch, if a rock or tree is handy. Prop the base of the jack against the tree, run a rope to the jack—and you're all set.

Tailoring your car for trails. If you're really serious about rough-country driving, scout the optional heavy-duty parts offered today by auto manufacturers. They include stiffer springs and shocks, limited-slip differential, 15-inch wheels, oil filter, and heavy-duty brakes.

A manual transmission is a better choice than an automatic, since it gives you more control. Also, it's usually sturdier than its counterpart. Even more flexible is a four-speed gearbox, now available on many makes of cars. As final fillips, you might weld sheets of metal under the gas and oil pan, to help prevent punctures. A recessed oil-pan plug can also save grief.

That's it, and not so awesome, after all. Just good sense, combined with equipment based on the extent of your bypath cruising. ■ ■

Short Cuts and Tips

FROM PS READERS

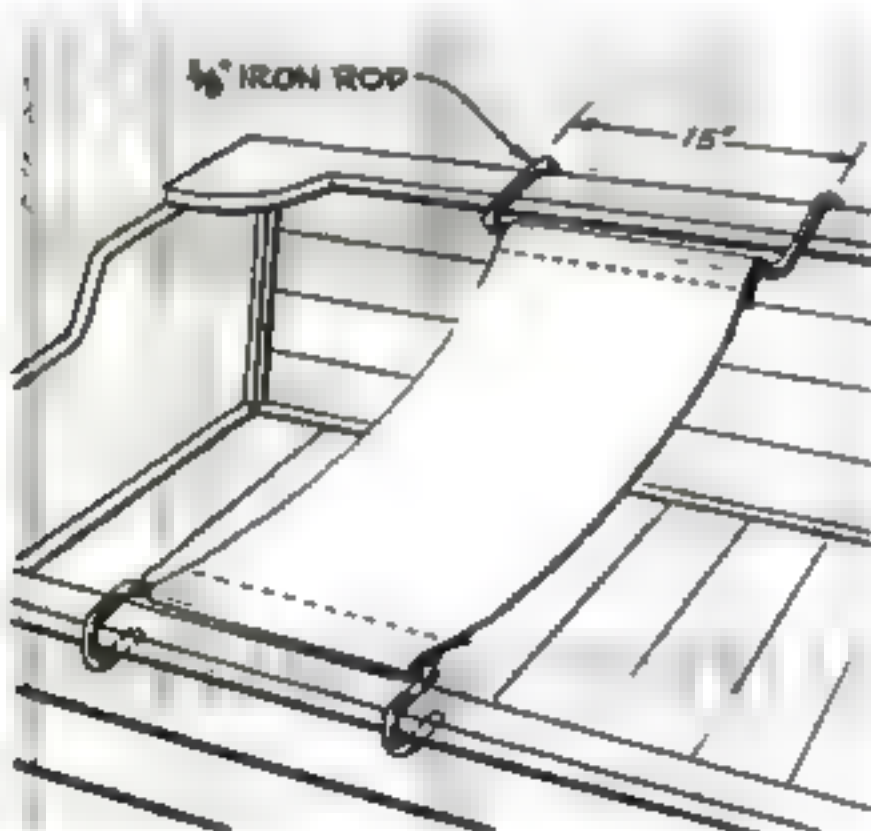


Plywood board-and-batten wall

Want to install board-and-batten siding? Substitute $\frac{3}{4}$ " PlyScord (or other plywood sheathing) for the boards. When painted, it looks just as good. And while it does a better job of bracing the wall, it can cost up to $\frac{1}{2}$ less. The two-by-four framing is

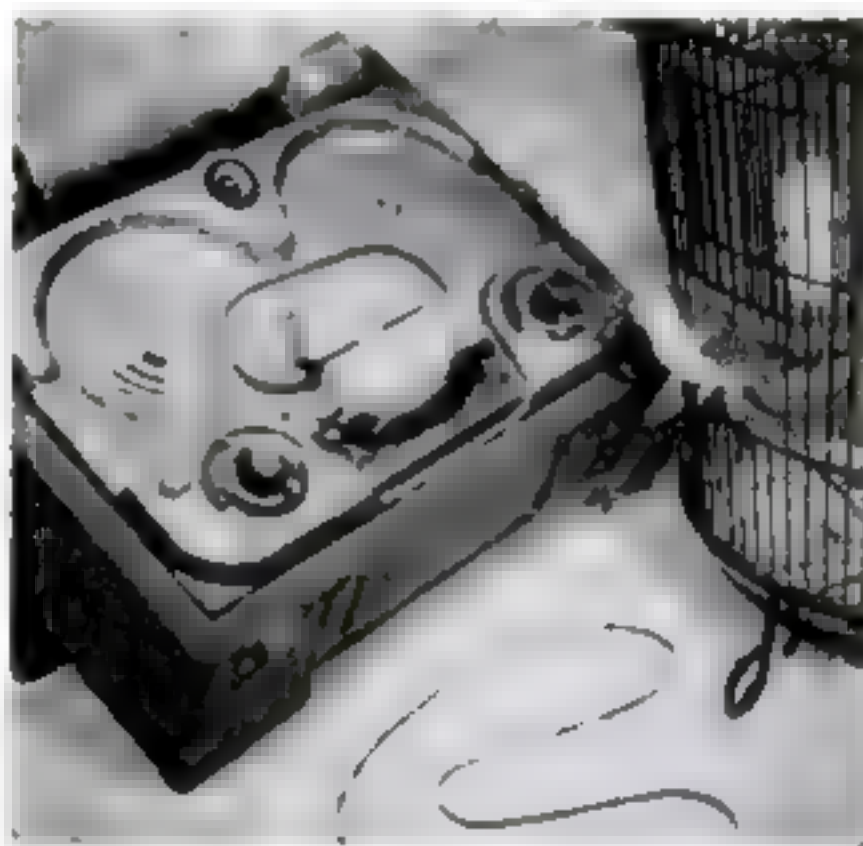
the same as for regular board-and-batten work: 4' on center vertically, 2' o.c. horizontally.

For greater strength, nail panels right over window frames and saw out openings later. Nail standard $\frac{1}{2}$ "-by-3" battens at 12" intervals—or rip rough one-by-twelves into strips.—*Paul Corey, Sonoma, Calif.*



Sling seat for boating comfort

Plank seats feel mighty hard after a day's fishing. You'll be more comfortable in a canvas seat slung between the sides of the boat. Stitch strong hems at both ends of a strip of heavy duck. Run a length of rod through each hem, and bend the ends into supporting hooks to fit over the gunwales.—*Ken Murray, Colon, Mich.*



Tape teaches bird to talk

Repetition of a single word or phrase is the way to teach a parakeet to talk. If you record the lesson on a short piece of tape, splice this into a loop, and insert it for playback, your words will repeat themselves for the bird while you are away or attending to other matters.—*Louis Hochman, Sherman Oaks, Calif.*

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4TH DIVISION Deadeyes: The 94th Infantry Division, veterans of the Leyte and Okinawa campaigns of World War II, will hold its 8th annual reunion at the Baker Hotel, Dallas, Texas on July 26, 27 and 28, 1962. Please contact Richard Klassen, Rt. 1, Kankakee, Illinois, for complete reunion, Division History and roster information.

80A REMAILING SERVICE

RENO remails 25c. Monthly \$3. Gorn-knotie, Box 2878-B, Reno, Nevada.

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REMAILING-Unlimited. Write for free information. Iota, P.O. 20441, Dallas, Tex.

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Interested in Radio·Audio·Electronic kits?

Then here is important news for you

Milton B. Sleeper, noted figure in electronics, tells you about the R·A·E Society—and how you can get the most out of kit-building.

A SOCIETY FOR KIT BUILDERS ... THE BIRTH OF AN IDEA

"I have always felt," says Mr. Sleeper, "that there ought to be an organization for people interested in Radio·Audio·Electronic kit-building. Just as there are clubs and leagues for stamp collectors, photo fans, radio hams and other hobbyists, a society for kit enthusiasts with its own publication would be a boon to the many people who enjoy this exciting pastime. And it could do so much to help newcomers get started."

THE R·A·E SOCIETY

About a year and a half ago, a group interested in kit building—several engineers, a physician, a lawyer and a number of businessmen—asked Mr. Sleeper to help form such a society. A local club was soon organized, adopting the name R·A·E to signify Radio, Audio and Electronics.

News of the club got around, and inquiries began to come in from far and near. It was immediately evident that this society idea filled a far greater need, for more people, than a local club could encompass. It also revealed that people interested in kit building have many valuable ideas about kits and how they should be designed.

The R·A·E Society quickly grew into a national organization. It has already attracted more than 6,000 members. Applications are pouring in from every section of the country—from beginners as well as experienced kit builders, and from people who would like to start.

New projects in which you will want to participate are made possible for the first time by this group activity. Some are things you have probably thought about doing but couldn't do by yourself. You'll read all about R·A·E Society plans in the coming issues of the R·A·E Journal. Whether you are a complete novice or an advanced kit-builder, or a father who wants to interest his son in this challenging hobby, you are invited to take part. You will enjoy these benefits immediately:

THE R·A·E SOCIETY'S QUARTERLY JOURNAL

Members of the Society are now receiving their first copies of the eagerly-awaited first issue of the Society's unique R·A·E Journal. A limited number of extra copies has been set aside to take care of new-member requirements. By acting now, you can get this first-edition issue as part of your regular membership privileges.

Articles by expert kit-builders are written in an interesting, understandable style, elaborately illustrated with photos and diagrams, and printed on fine paper. Look for the previews of the first kits designed by kit-builders. Among the articles on equipment are:

- NEW: Modular Stereo FM Tuner
- NEW: Electronic Crossover Network
- NEW: Mono Preamp Convertible to Stereo
- NEW: 36 Plans for High-Quality Installations
- PLUS: New Concepts of Kit Design.

YOU CAN'T BUY COPIES OF THE JOURNAL

Copies of R·A·E Journal are available ONLY to members of the Society. The \$1 annual membership dues entitles you to four issues as one of the benefits of membership—free of charge. No copies can be bought anywhere.

MORE ABOUT THE QUARTERLY JOURNAL

Milton B. Sleeper, noted figure in electronics and Chairman of the R·A·E Society, heads the editorial staff. The Journal

is devoted exclusively to subjects of interest to kit builders—newly developed R·A·E kit designs, Advance-Test Panel reports, high-quality mono and stereo installations from the simplest to the most complete, recording techniques, testing and maintenance methods, and how-to articles on improving performance from records, tape, multiplex FM and TV sound.

The Journal includes a regular "I Think" department where members air their opinions about what they like or don't like in available kit designs, circuits, and assembly methods. News and critical views of subjects related to radio, audio and electronics are covered in "Notes and Comments". A "Buy, Sell and Swap" section is available to members without charge. In short, the Journal contains a wealth of informative, authoritative, and reliable information not available from any other single source. Its contents are refreshing, stimulating and provocative.

R·A·E MEMBERS TO SERVE ON ADVANCE TEST PANELS

R·A·E will manufacture totally new types of radio, audio and electronic kits. Designs, instructions and assembly techniques will reflect the kit builder's point of view, and will be based on the actual experience of members of the Society.

Before any new R·A·E kit is released, 10 prototypes will be tested by an Advance-Test Panel composed of 10 Society members. Each will receive a kit to assemble, and will report his findings. The completed kit will then become his property at no cost to him. A new Panel will be chosen for each new kit; no member will serve twice. Any Society member may qualify to serve on the Advance-Test Panels. No purchase of equipment is necessary to participate.

RUSH YOUR MEMBERSHIP APPLICATION TODAY!

Just \$1 pays for your first year's dues in the R·A·E Society, and entitles you to all privileges of membership, including four issues of the quarterly Journal. It qualifies you to be chosen to serve on an Advance-Test Panel, and to participate in many other activities to be announced from time to time. By acting now, you can still receive a copy of the first issue of the Journal, and you will be eligible to serve on the first Advance-Test Panels now being selected.

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